Alcatel-Lucent OpenTouch Suite for Mid sized and Large Enterprises

Standard Offer

Chapter 13 - Topology – Network Services

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This document introduces the Alcatel-Lucent OpenTouch and OmniPCX Enterprise Communication Server, their products and features. All documents associated to this introduction cover most of the aspects for designing offers based on current manufacturers and business partner agreements. They include introductory explanations to position the offer in relation to client needs. References to in-depth documentation are indicated to direct you to product descriptions or product sites.

Who Should Use this Document?

As an introductory offer, this document can be used by Alcatel-Lucent Enterprise vendors, clients, partners and associates involved with the implementation of Alcatel-Lucent systems.

Table of contents

1 Topology overview - deployment design 4

2 Distributed architecture with centralized call control 5

2.1 Basic architectural configurations 5

2.1.1 Media gateway example 6

2.1.2 TDM and media gateway example 7

2.1.3 TDM and Appliance Server example 8

2.2 Interconnecting IP media gateways 8

2.2.1 Configuration 9

2.2.2 Maintenance 9

3 Distributed architecture with networking call control 10

3.1 Corporate ABC networking: infrastructure 10

3.1.1 Private network configurations and scalability 11

3.1.2 Private ABC networks using TDM leased lines 12

3.1.3 ABC virtual private networks (VPNs) on ISDN/PSTN networks 12

3.1.4 VoIP networking in ABC networks 14

3.1.5 Private ABC sub-networks using ABC trunk groups on IP 17

3.2 ABC network features 18

3.2.1 Private numbering (dialing) plan in an ABC network 19

3.2.2 Network-wide telephone features 19

3.2.3 User group features 20

3.2.4 Mobility features 20

3.2.5 Centralized or distributed attendants 20

3.2.6 Centralized, distributed, or shared voice messaging systems 21

3.2.7 Distributed contact center 22

3.2.8 Adaptive routing 22

3.2.9 Alternate route selection (ARS) 23

3.2.10 Management of an ABC network 24

3.2.11 Business continuity in case of Communication Server switch-over 26

3.3 Heterogeneous networking 27

3.3.1 ISVPN (country dependent) 27

3.3.2 DPNSS networking 28

3.3.3 QSIG 28

3.3.4 SIP interoperability 30

3.3.5 OmniMobility voice over wireless LAN 30

3.3.6 OmniMobility DECT 52

Note: this chapter concerns the OmniPCX Enterprise only. For the OpenTouch Business Edition, OpenTouch Message Services, or OpenTouch Message Services integration in OmniPCX Enterprise networks see the corresponding OpenTouch documents.

1 Topology overview - deployment design

The Alcatel-Lucent OmniPCX Enterprise Communication Server is part of the next generation of enterprise IP-PBX communication systems. It is designed around native IP technologies and allows the customer to deploy mixed or legacy solutions to support a converged data-voice network.

The Alcatel-Lucent OmniPCX Enterprise Communication Server architecture provides a single logical communication system whose benefits are:

- Scalability and ability to increase system performance and increase the number of supported users: flexible solutions for businesses of all sizes
- Resiliency and reliability, producing a highly stable service level consistent with its use
- Easy access from anywhere: communication solutions fit to all types of user profiles
- Technologically transparent: smooth migration of existing network
- Easily upgradeable and future-proof: protect and leverage existing investments

This flexible architecture allows the Alcatel-Lucent OmniPCX Enterprise Communication Server to be installed and operated in a totally distributed design configuration on a single site (campus) or across multiple sites.

The Alcatel-Lucent OmniPCX Enterprise Communication Server is designed to meet the needs of all types of architectures and configurations. The choice of a telecommunication solution is mainly based on topology and architecture. Alcatel-Lucent OmniPCX Enterprise Communication Server solutions can address the following deployment models, offering state-of-the-art telephony services:

- A single-system for a local environment. The simplest package is based on a single Appliance configuration containing embedded applications.

  Depending on the licenses, users can access the Messaging, Conferencing, Collaboration, Security services.
- A **centralized** call handling system with distributed hardware solution for a campus environment or multi-site environments (e.g. branch offices). A centralized call handling implies a central Alcatel-Lucent OmniPCX Enterprise Communication Server, controlling one or more remote Media Gateways, located locally or in remote sites
- A **distributed** call handling system with distributed hardware solution for multi-site environments. A distributed call handling implies several Alcatel-Lucent OmniPCX Enterprise Communication Servers. The Alcatel-Lucent OmniPCX Enterprise Communication Server can be networked to cover multiple buildings, sites, or campuses, at various geographic locations. In these types of configurations, each Alcatel-Lucent OmniPCX Enterprise Communication Server is considered as a network node

Alcatel-Lucent OmniPCX Enterprise Communication Server solutions are not limited by the network infrastructure and can operate on IP (H.323 and SIP included) and TDM.

These different types of infrastructure can co-exist in the enterprise.

The OmniPCX Enterprise allows a network consisting of several sites to be built with a high level of service integration and transparency. It also allows interconnection with legacy PCXs or with next generation IP-PBXs using digital TDM or IP technology.

2 Distributed architecture with centralized call control

In a distributed architecture with centralized call control, only one communication server handles calls (although it may be duplicated for standby) for all sites. The Alcatel-Lucent OmniPCX Enterprise Communication Server is supported on an IP appliance server (IP AS), an IP rack server (IPRS), or an IP crystal server (IPCS). The server is typically installed at the central site.

2.1 Basic architectural configurations

The platform choices for both communication servers and media gateways provide a maximum number of combinations to fulfill customer needs. Among the main advantages are:

- Flexibility: platforms to meet any size of company up to 100,000 users (telephony features are the same for all the users regardless of their location)
- Scalability: possible accumulation of media gateways either linked via IP or TDM
- Backup: possible separation of platforms:
  - Between communication servers and media gateways (the server is placed in the Application Server for best maintenance and backup practices)
  - Between main and standby communication servers for geographical separation (different physical locations, or "spatial redundancy—duplication")
- Smooth transition from a full TDM to mixed or full IP configuration

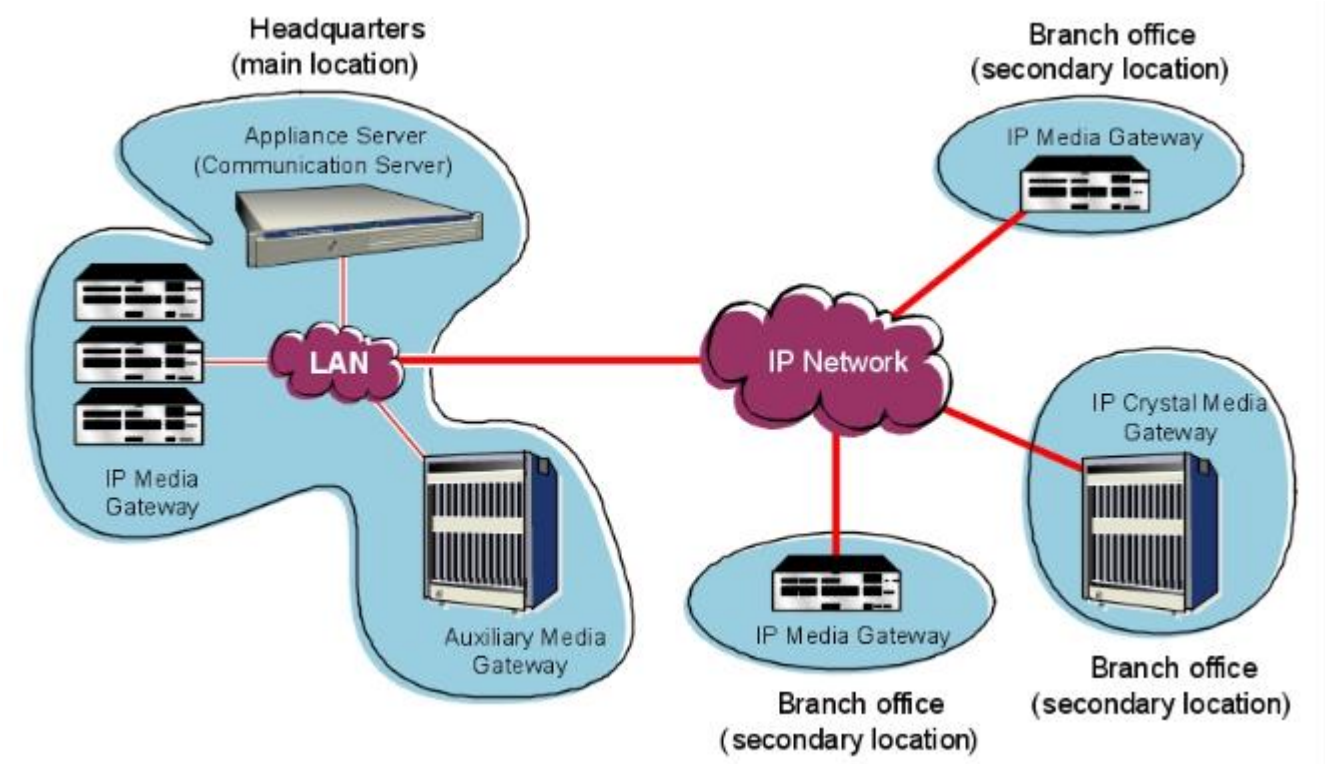
A number of restrictions exist in mixing different kinds of platforms. They are summarized in the following table:

Type of Communication Server (CPU) in main location	**Main location**	**Secondary - remote - location**
IP Appliance Server or Blade Center	Common hardware IP media gateway OR Crystal IP media gateway (possibly with one level of peripheral Crystals)	Common hardware IP media gateway OR Crystal IP media gateway
OpenTouch Business Edition/OpenTouch Business Edition hosted	Common hardware IP media gateway	Common hardware IP media gateway
IP Crystal Server	Crystal Communication Server (possibly with two levels of peripheral Crystals)	Common hardware IP media gateway OR Crystal IP media gateway
IP Rack Server	Crystal IP media gateway AND Auxiliary media gateway (if necessary)	Common hardware IP media gateway OR Crystal IP media gateway

Possible example configurations are described in the following sections.

2.1.1 Media gateway example

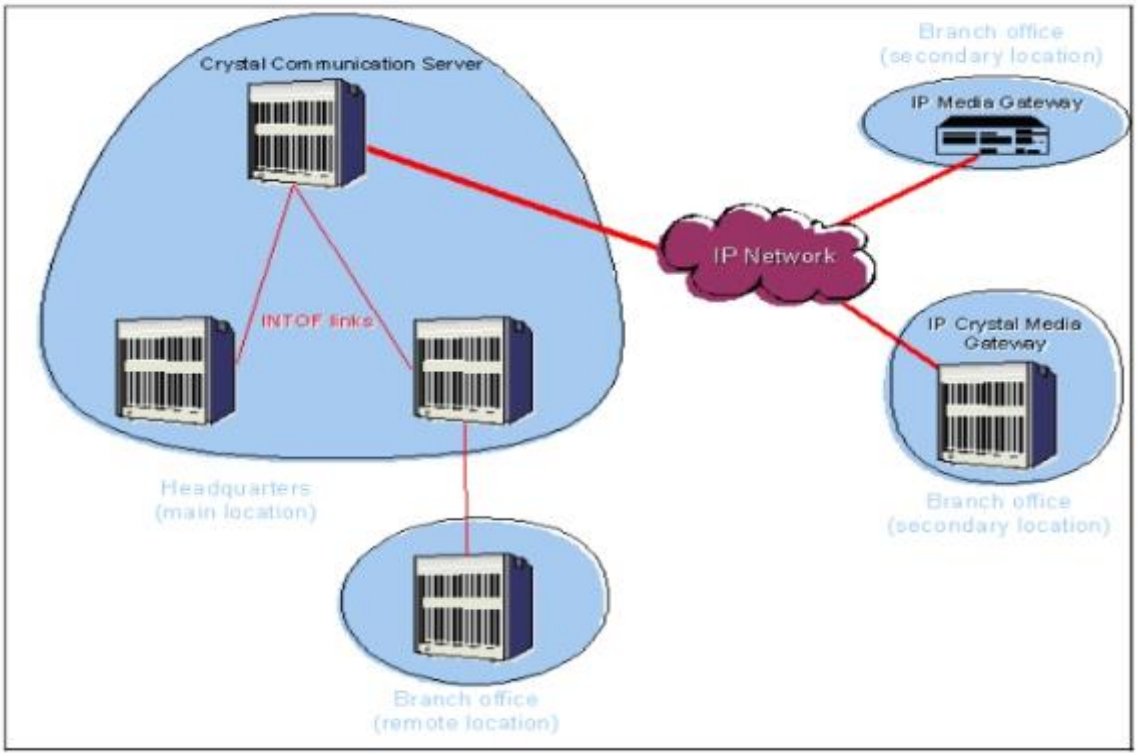
The following figure illustrates a configuration based on an IP media gateway. In the main location, an auxiliary media gateway is used for additional features (large DECT configurations, 4645 voice mail server).



2.1.2 TDM and media gateway example

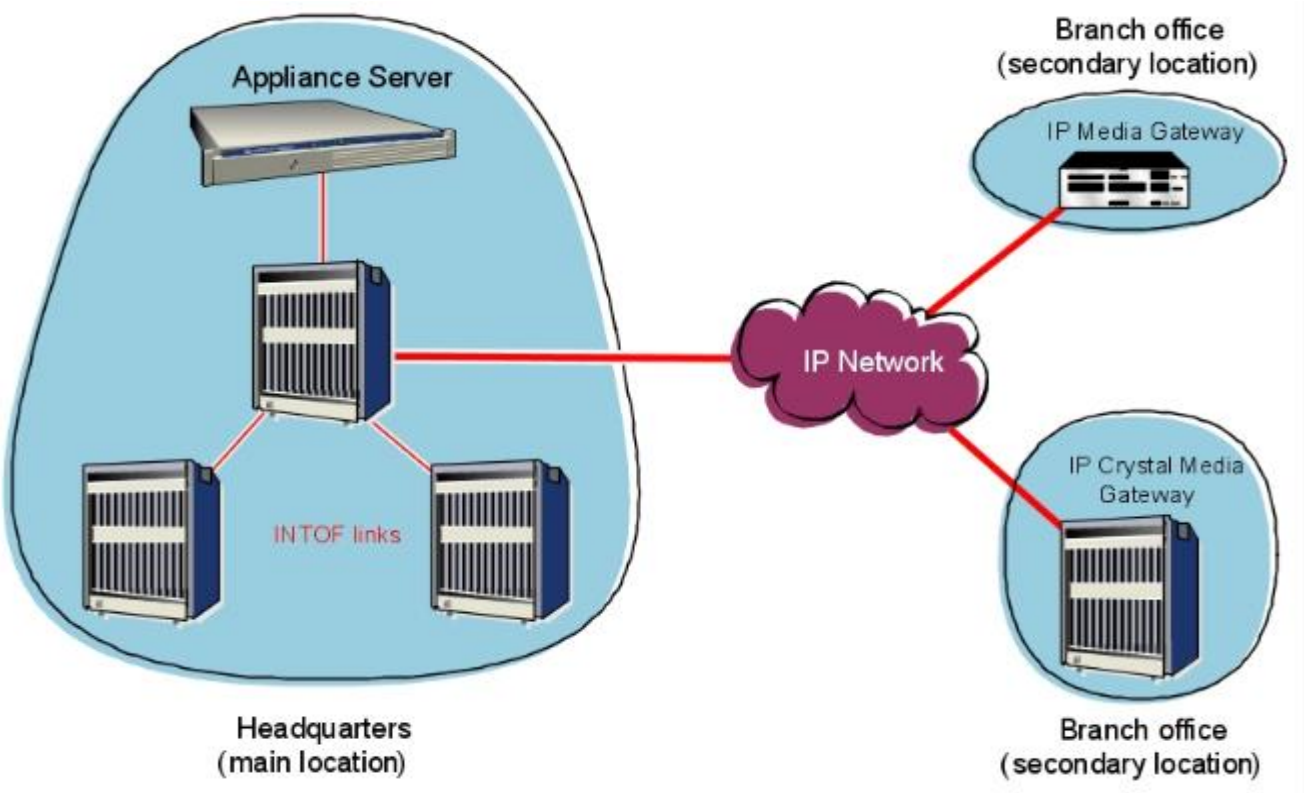
This configuration shows a full TDM system for the main location (headquarters), possibly resulting from an OmniPCX Enterprise migration. One branch office is equipped with a Remote Crystal shelf linked to the multi-level ACT structure.

To take advantage of the IP network, new branch offices are equipped with IP (Crystal and IP media gateways).



2.1.3 TDM and Appliance Server example

This configuration shows a full TDM system in the main location, but uses an IPAS placed in a secure location. In this case, the number of Crystal chains is limited to two. All branch offices are equipped with IP (Crystal) media gateways.



2.2 Interconnecting IP media gateways

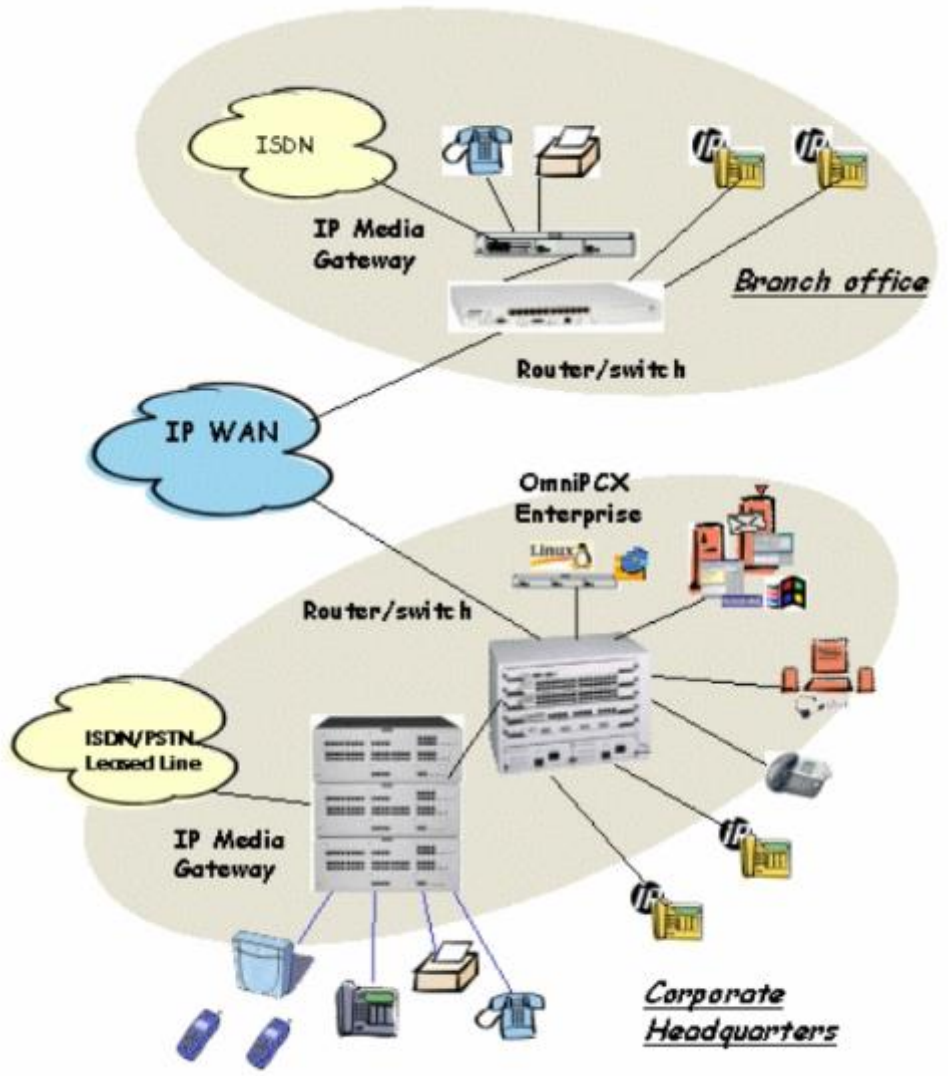
The Communication Server architecture requires a voice enabled IP network interconnecting each business site (physical connections often based on routers over frame relay or leased lines).

Typically, IPMGs are interconnected through the data network (LAN or WAN). Optical fibers can also be used (avoids using the customer data network in campus network). This is based on the use of integrated LAN boards (LAN 16) and devices called media converters, which convert 10/100BaseT Ethernet for transmission over fiber (these devices are not provided by Alcatel-Lucent).

Remote sites can be equipped with:

- IP telephony only, with small analog VoIP gateways for fax support (for example, Audiocodes MP1x)
- IP telephones as well as complementary media gateways for legacy interfaces (NDDI / NDID analog networks, Z (analog), digital T0, T1, or T2)
- Media gateways used to connect digital phones, fax machines, analog phones, and DECT base stations to the network

The remote equipment is controlled over the IP network (typically a WAN). All inter-site connections use VoIP. In most cases, a typical remote site configuration has between one and 50 extensions.



The Alcatel-Lucent OmniPCX Enterprise Communication Server can control up to 240 racks (IP Rack Module and IP Crystal Rack), distributed over an IP-based WAN, with a maximum of 90 IP Crystal Server racks.

Note: An IP media gateway (IPMG) consists of one, two, or three racks. An IP Crystal media gateway has one rack.

2.2.1 Configuration

Configuring an IP Media Gateway is easy. It consists of:

- Cabling
- IP parameter programming [dynamic (DHCP) or static IP addressing (through craft port V24)]
- Overall functional control of local equipment

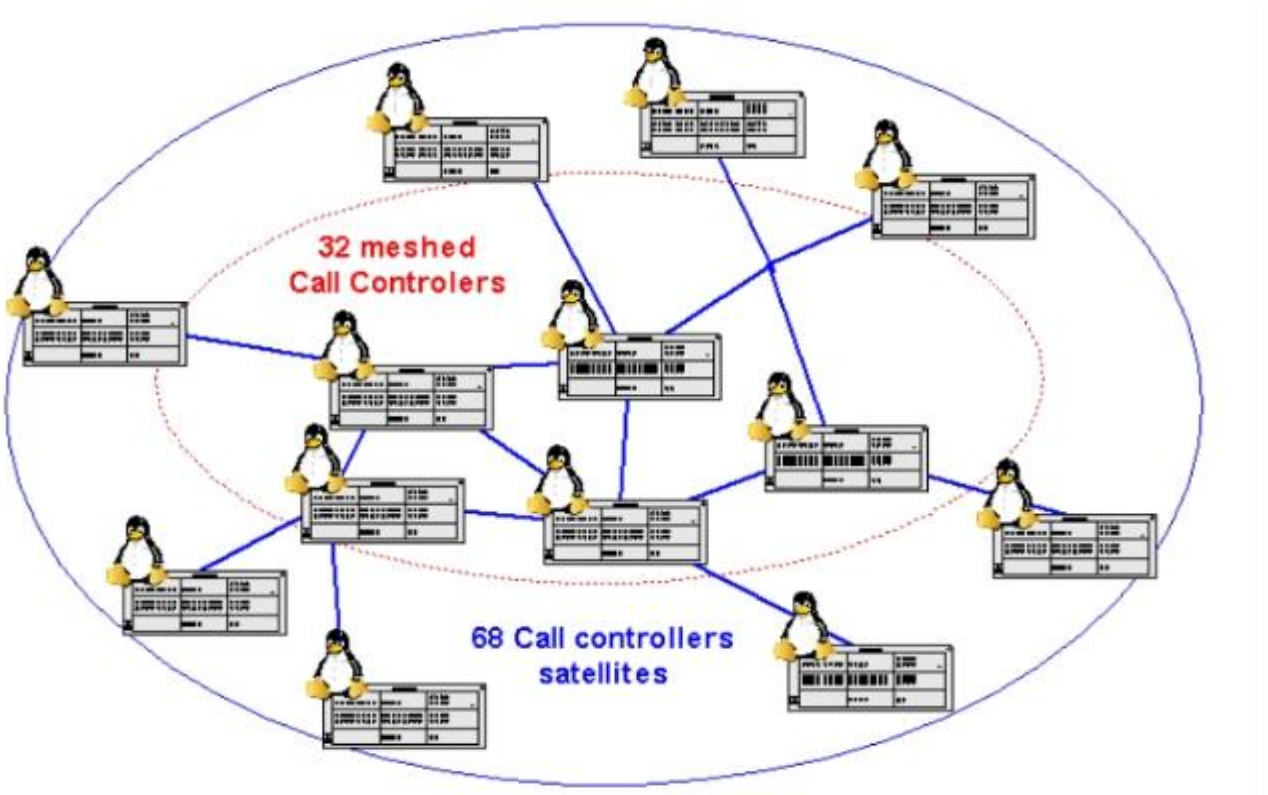
2.2.2 Maintenance

Maintenance (moves, adds, changes, or changes to user service parameters) is simplified and is performed by the central organization.

3 Distributed architecture with networking call control

3.1 Corporate ABC networking: infrastructure

The Alcatel-Lucent OmniPCX Enterprise Communication Server can support up to 100,000 users (TDM, DECT, IP) using various geographic design topologies (legacy or IP). In case of a legacy topology (TDM), the networked configuration can support up to 32 fully/partially meshed Communication Servers and 68 satellite Communication Servers for a total network configuration of 100 systems with full transparent features.

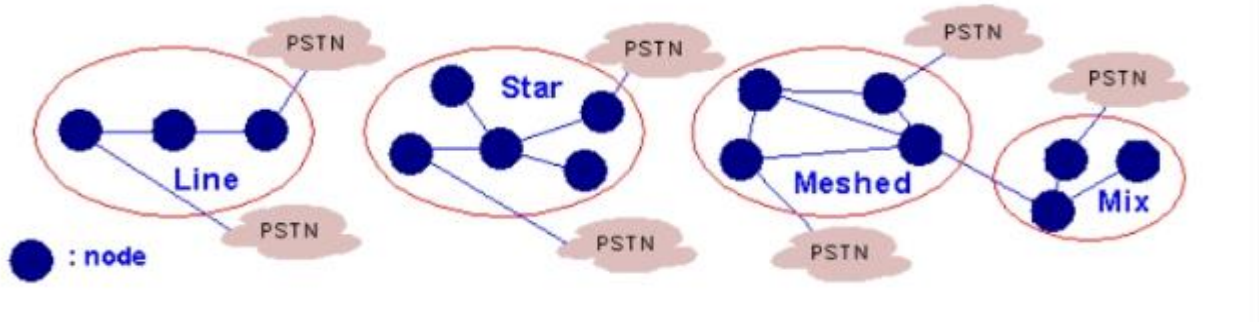


The networked solution uses the powerful Alcatel-Lucent Business Communications (ABC) protocol, which is based on and compatible with ETSI QSIG.

The Alcatel-Lucent OmniPCX Enterprise Communication Server can be networked in various topologies: line, star, full meshed, or a combination of these.

In general, interconnections are made through:

- TDM leased lines
- ABC-VPN over ISDN/PSTN
- IP



Homogeneous networks may consist of Alcatel-Lucent OmniPCX Enterprise Communication Server R10.0 nodes only, or may include nodes of Alcatel-Lucent OmniPCX Enterprise Communication Servers R10.0, R9.0, R8.0, R8.0.1 and R7.1.

If in the customer network, some nodes run in releases under 9.0, a smooth transition is still possible by interconnecting nodes in different versions during a controlled migration period. During this specific period, in a same homogeneous network, for instance, you can have a node in release 8.0.1 and another one in R10.0.

This allows customers to migrate on a node-by-node basis without compromising existing services or features.

Restrictions on features

When a new ABC-F2 service is introduced in a software release, this service can only be handled on a system with the same software release level ("end-to-end service"). However, due to the "message transparency" service included in the ABC-F2 protocol, nodes running a lower level of software release can route new messages.

Implementing "disallowed" configurations can lead to poor VoIP quality because of voice compression/decompression cycles. Guidelines are available to build a VoIP solution that ensures the best possible voice quality and interactivity to voice communication over an IP network.

3.1.1 Private network configurations and scalability

Supranetwork (More than 100 Nodes)

Several homogeneous Alcatel-Lucent OmniPCX Enterprise Communication Server networks can be linked together in an extended configuration called a "supranetwork." In a supra-network, homogeneous networks (made of 1 to 100 nodes) are linked together through a TDM ABC-F Trunk Group or an IP ABC-F Trunk Group.

An ABC-F Trunk Group will be used instead of an ABC link to:

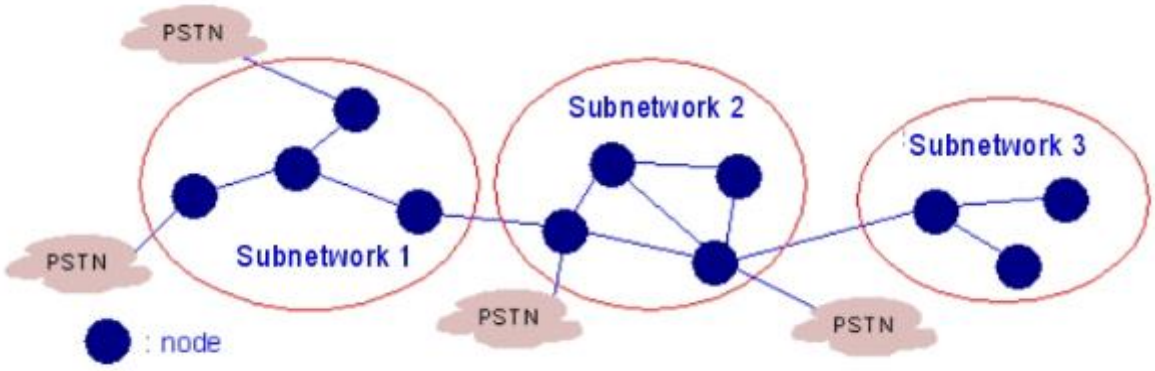
- Answer scalability requests (above 100 nodes or above 100 000 terminals in a sub-network; up to 250 sub-networks)
- Cope with customer requirements in terms of organization or/and numbering plan:

Each sub-network can be fully managed independently.

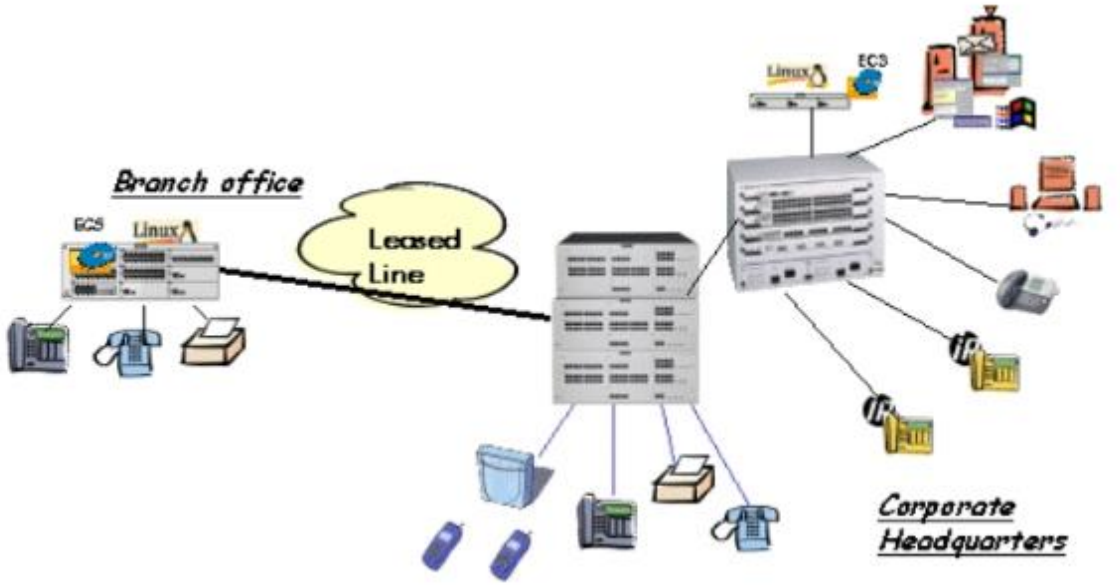
The numbering plan can be homogeneous or heterogeneous.

If the ABC-F (Features), ABC-M (Management) and Virtual Services are carried by an ABC link, only ABC-F is carried by an ABC-F Trunk-Group. So, in a supra network, homogeneous networks are managed independently and the applications (e.g., Voice Mail) are centralized at the level of each homogeneous network.

In a supra-network, each homogeneous network retains its own external connections and attendants. Therefore, one of the advantages of this configuration is that a large company with an international scope can have an enterprise-wide network while maintaining local connectivity to the PSTN.



3.1.2 Private ABC networks using TDM leased lines



Systems can be interconnected using:

- G.703/G.704 T1/E1 leased lines. ABC signaling is transported using TS16. Voice is transported in remaining digital frames
- Systems can be interconnected using several T1/E1 interfaces or a part of a single T1/E1 (fractional T1/E1). It is also possible to provide ABC-VPN over leased lines. If the leased line is saturated, additional calls are routed over the public network (providing that the user has the correct class of service)

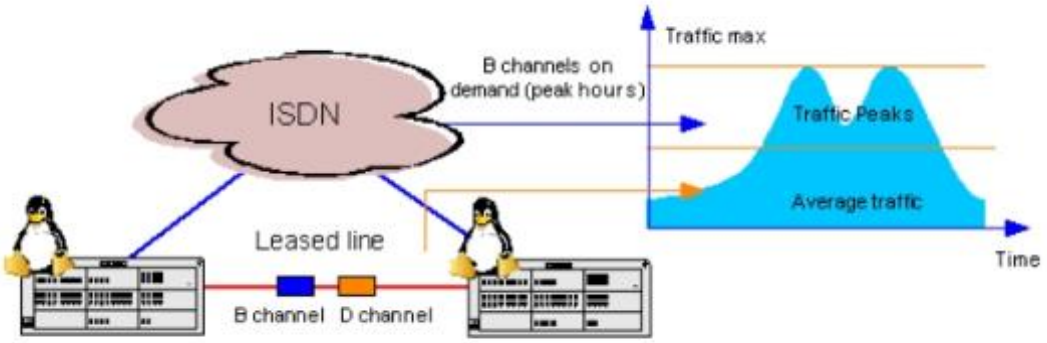
Note: ABC networking over analog leased lines is also supported. In this case, the Crystal media gateway is used to provide the tie line interfaces required (ACEM, EMTL boards).

3.1.3 ABC virtual private networks (VPNs) on ISDN/PSTN networks

ABC VPN and leased lines

Cost restrictions related to private network designs often lead to bandwidth limitations. However, to provide maximum availability, private links must be sized to support peaks in network traffic. This results in some bandwidth being unused for long periods of time, and it increases monthly lease expenses. The best way to optimize bandwidth is to reduce the number of leased lines based on

average traffic requirements and overflow traffic during peak traffic periods to an alternative network, as illustrated below:



Service characteristics

The Alcatel-Lucent VPN configuration offers full ABC services regardless of the network used for voice transport. Telephone signaling always uses a reserved channel in the digital leased line (D channel).

The application uses virtual direct inward dialing (DID) to overflow calls when the leased line is saturated. A limited set of DID numbers are reserved for this service (according to the traffic), so as to integrate users with or without DID numbers into the network while saving DID subscription costs.

The network manager can precisely configure overflows. The service can be assigned user-by-user, so that the cost remains under control, while guaranteeing a good quality of service.

When the leased lines are saturated, a voice guide suggests an automatic callback request to a user who is not entitled to an overflow operation.

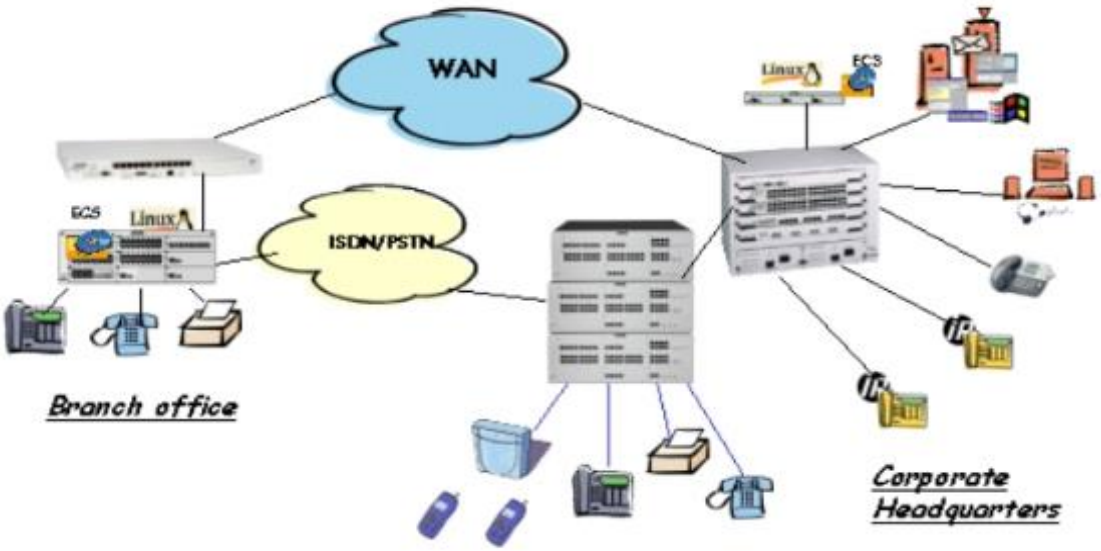
In addition, a flag is associated with each overflowed call in the Alcatel-Lucent OmniPCX Enterprise Communication Server metering (accounting) application. This gives the network manager precise data to analyze to ensure the service remains consistent over a period of time.

ABC VPN without leased line for voice

For some configurations with low traffic levels, a dedicated digital T1/E1 line is not cost effective. Today, many enterprises have switched from owned leased line networks to managed-switched voice networks (voice VPN).

For such topologies, the Alcatel-Lucent OmniPCX Enterprise Communication Server interconnects systems with full ABC services using the PSTN to support ISDN services, or a private QSIG network to transport voice and a permanent line to transport signaling, as shown below.

IP network:

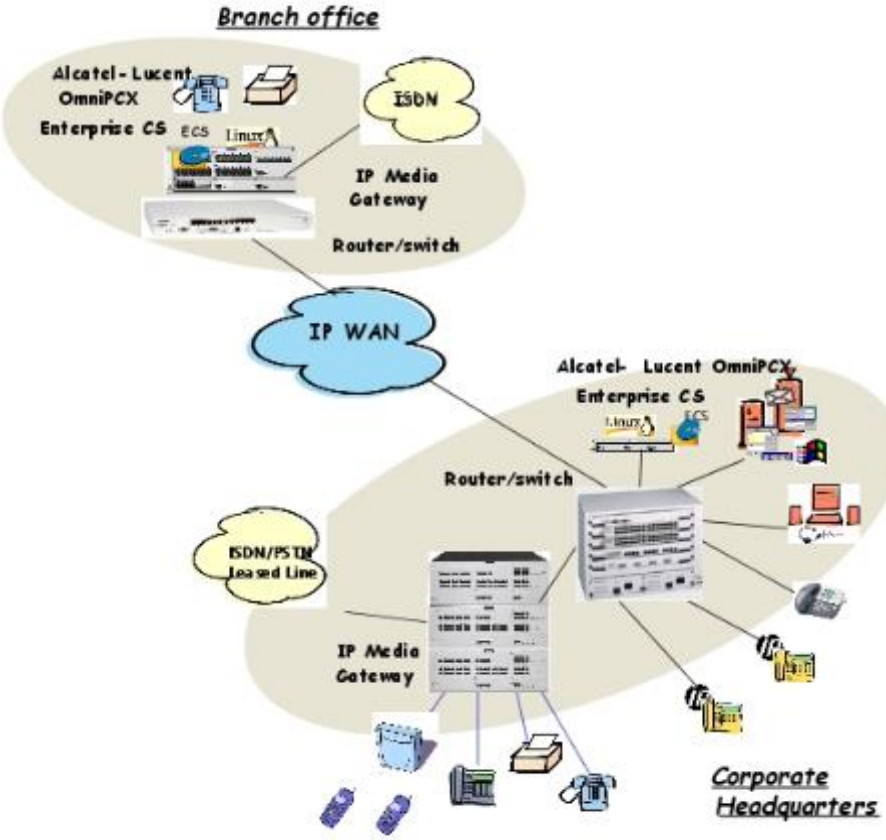


Service characteristics

The Alcatel-Lucent VPN configuration offers full ABC services. The service uses virtual DID. A limited set of DID numbers is reserved (according to the traffic requirements) so the application can integrate users with or without DID numbers into the network while saving DID trunk expenses.

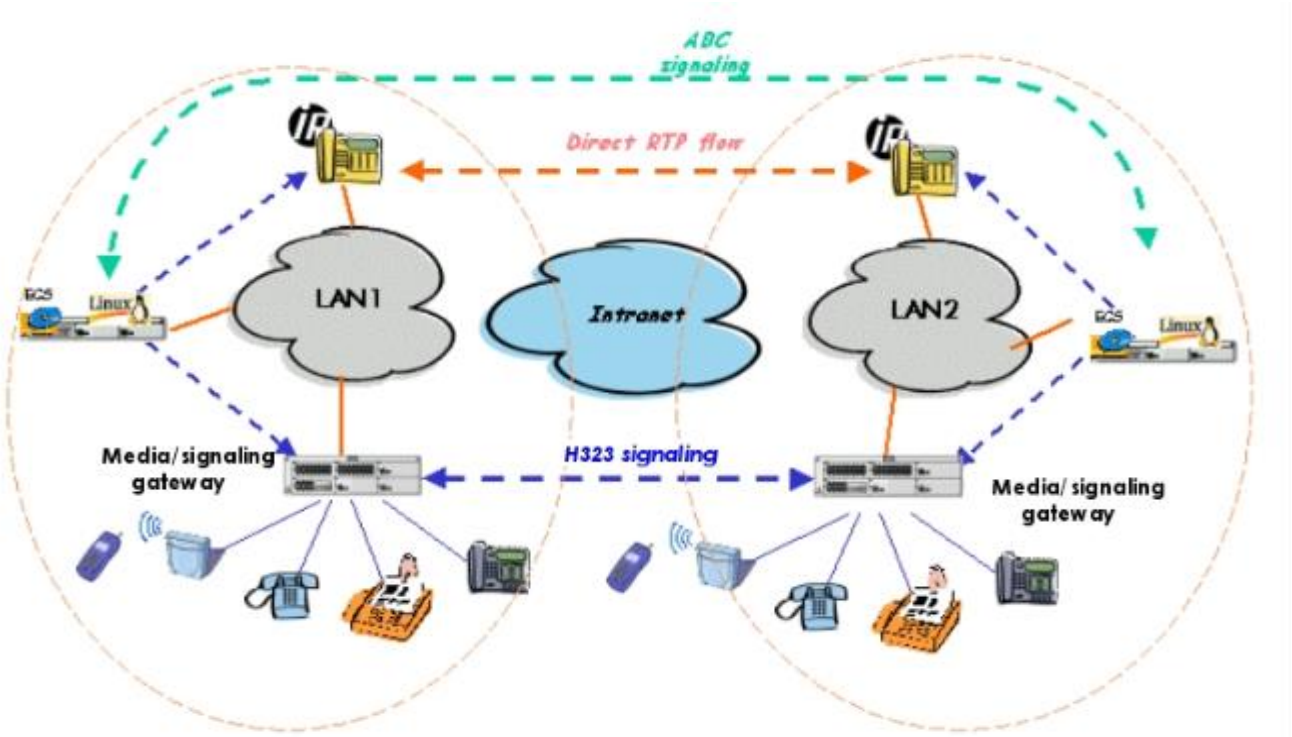
3.1.4 VoIP networking in ABC networks

The Alcatel-Lucent OmniPCX Enterprise Communication Server provides full feature transparency via leased lines and ISDN/PSTN networks. It provides the same transparent features when different Alcatel-Lucent OmniPCX Enterprise Communication Server systems in a private network are interconnected through an IP network.



The H.323 gateways and ABC building blocks provide:

- Standard VoIP (H.323): G.711, G.723.1 and G.729A voice codecs and fax
- A high level of feature transparency (ABC protocol)
- Direct RTP between IP phones and distributed media gateways on different nodes to minimize delay (no transit in the network)
- Ability for calls to overflow transparently to the ISDN/PSTN network when the IP WAN is out of service or if IP trunks are saturated (See Call Admission Control chapter)



Call admission control on H.323 VoIP networks using internal mechanisms

CAC (call admission control) is used to prevent a new call from being routed over the IP network if there is not enough available bandwidth. The call is rejected or is rerouted through the PSTN with complete feature transparency.

Due to the characteristics of IP, it is not possible to dynamically adapt to the available bandwidth on the network. However, the Alcatel-Lucent OmniPCX Enterprise Communication Server performs CAC statically in two ways in an ABC network:

- Globally limiting the number of H.323/ABC calls on a node (e.g., if fixing a maximum of ten incoming/outgoing calls, the eleventh call will be rejected)
- This solution is well adapted to IP networks with a star topology (a single WAN link per node)
- Limiting calls per direction when the site has several WAN links to other sites. For example, ten calls in direction one, five calls in direction two, etc.

  This solution is well adapted to IP networks with a meshed topology.

Call admission control for SIP

CAC is used to manage the traffic for SIP phones in the same way as IP Touch phones or IP Media Gateways as the SIP endpoints are registered in the Alcatel-Lucent OmniPCX Enterprise Communication Server SIP Proxy.

A SIP phone making or receiving an intra-domain call will use the intra domain codec for the domain, typically G711.

If the maximum number of domain calls is reached, the SIP phone will be forced to use the pre-defined extra domain codec.

The CAC-SIP configuration (y/n) limits the number of SIP calls by domain to maintain voice quality.

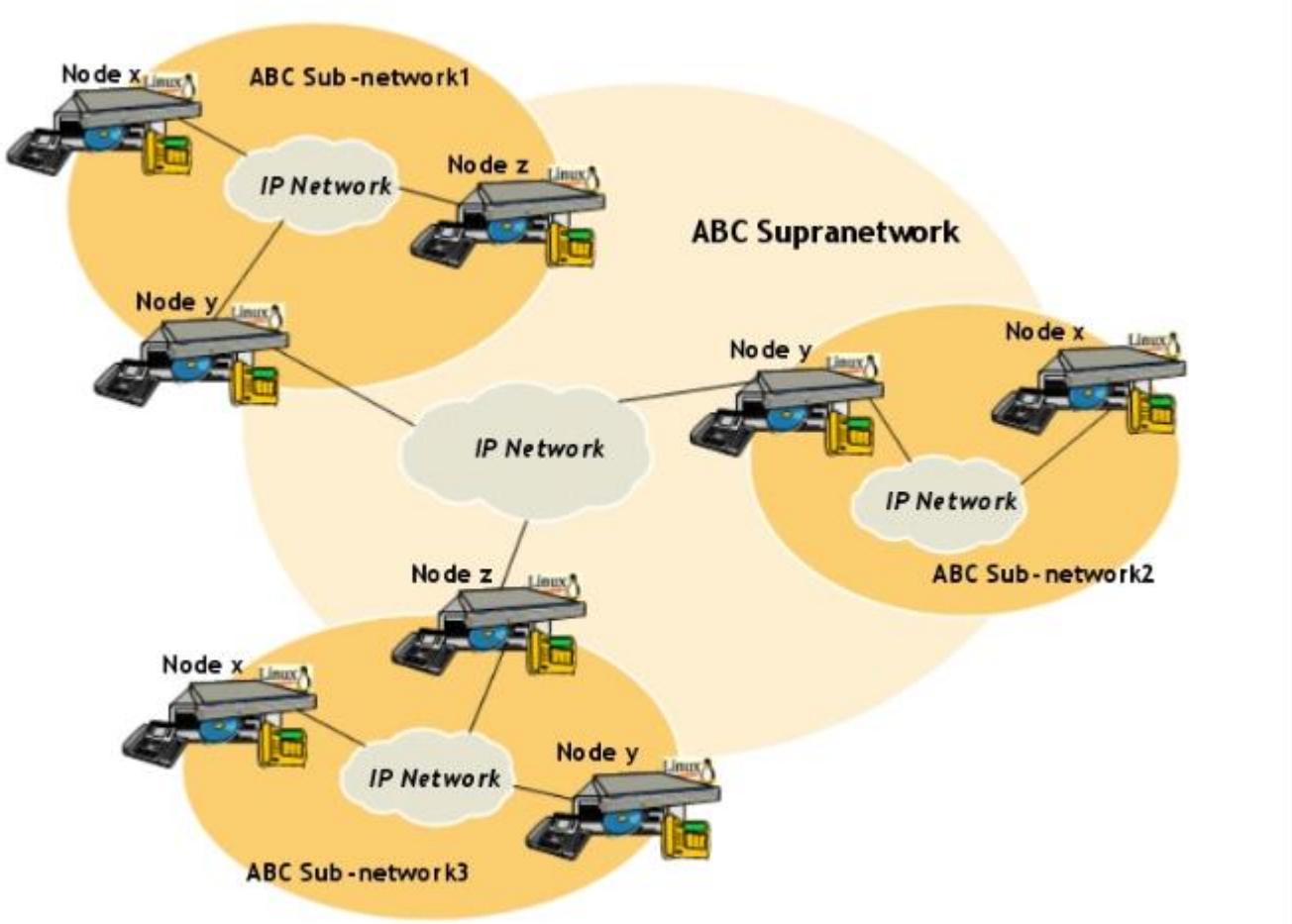
Note: Video is not possible if CAC-SIP is enabled.

3.1.5 Private ABC sub-networks using ABC trunk groups on IP

The ABC trunk groups on IP provide an alternative to the TDM leased lines to connect ABC sub-networks within a network consisting of ABC sub-networks (i.e. an ABC supranetwork).

The ABC trunk groups on IP enable a fully-fledged IP solution for communications within an ABC supranetwork. Within ABC sub-networks, the inter-node IP links are provided by ABC logical links on IP.

Via these IP links, the ABC supranetwork forms a global IP network where IP communications are ensured from their beginning to their end within the ABC supranetwork.



Within an ABC supranetwork, up to 250 ABC sub-networks can be connected via ABC trunk groups on IP.

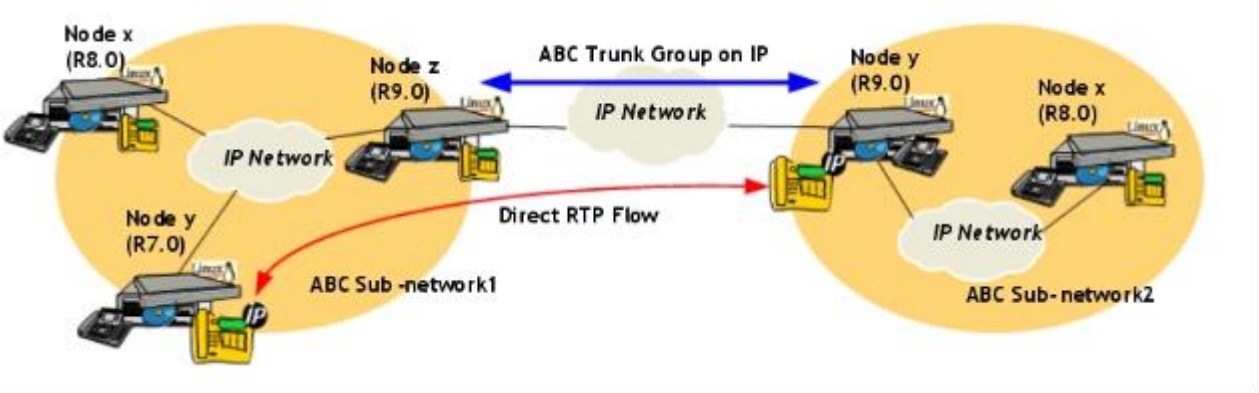
- When there are too many Communication Servers in an ABC sub-network (OmniPCX Enterprise product limit)
- For customer deployment and organization (per area)
- For numbering plan issues (within an ABC sub-network, the numbering plan must be homogeneous)

Services provided by the ABC trunk groups on IP are:

- Same level of services as TDM leased lines
- Direct RTP between IP devices located on different ABC sub-networks
- Call Admission Control (CAC) over IP

- IP Touch Security service (encryption)
- T.38 fax communications over IP
- Possibility to configure heterogeneous numbering plan in the ABC supranetwork
- Compatibility with current network services of the Alcatel-Lucent OmniPCX Enterprise Communication Server (e.g. Automatic Route Selection)

An ABC-F Trunk Group on IP can only be configured between two nodes (of different ABC sub-networks) in R9.0 or higher. An ABC sub-network can contain nodes in releases lower than R9.0 (this depends on the Alcatel-Lucent compatibility between releases).



Use of ABC trunk groups on IP implies the following restrictions:

- Both ABC trunk groups on IP and TDM leased lines cannot be supported at the same time between two ABC sub-networks
- Only one ABC trunk group is supported between two nodes located on different ABC sub-networks

3.2 ABC network features

Distributed call handling is available for enterprises with multiple sites.

Each site is equipped with a specific Communication Server E-CS (which may be duplicated), using the same basic software as typical single-site configurations (classic or IP configured).

The servers are interconnected to provide the customer with all the expected benefits of networking (cost optimization, centralized resources, transparent service for the end user, centralized management, etc.)

These services are supported by the enhanced ABC (Alcatel-Lucent Business Communications) protocol, which is compatible with the QSIG-GF standard.

The ABC protocol has four main modules:

- ABC-F for feature transparency - provides users with the same telephone services regardless of their location in the enterprise.
- ABC-M for network wide management - allows centralized, simplified management
- ABC-R for network wide routing - optimizes routing for cost/resource optimization and simplifies routing management
- Virtual services which carry the ABC-A (Application) protocol which allows the centralization of applications (e.g. voice mail centralization) but also specific information relating to the call distribution or multi-line feature (there can be managers located in one node and their assistant located on another node, a phone connected on a node may be supervised from a phone connected on another one, etc.)

Because of its support for QSIG-BC and GF protocols, Alcatel-Lucent OmniPCX Enterprise Communication Server inter-PBX networking interoperates with third party QSIG devices and/or PBXs.

3.2.1 Private numbering (dialing) plan in an ABC network

The private numbering (dialing) plan is homogeneous. Directory numbers can have up to eight digits in an ABC homogeneous network (each number is unique in the network).

In a network of homogeneous ABC networks (supranetwork) or a QSIG network, the private numbering (dialing) plan can be heterogeneous (between homogeneous networks) and can support up to 20 digits.

Moving a user in an ABC homogeneous network

A user who moves from one node to another can keep the same phone number (number portability). This is particularly important in campus networks where users often move but want to keep their telephone numbers.

3.2.2 Network-wide telephone features

The Alcatel-Lucent OmniPCX Enterprise Communication Server provides the following network-wide features:

- Basic call
- Number and name identification
- Call/dial by name
- Call waiting indication
- Call offer
- Callback on busy links
- Callback on free or busy extensions
- Call park
- Call forwarding
- Camp on
- Individual call pick-up
- Data call
- Distinctive ringing
- Hold
- Intercom call
- Consultation call
- Broker call
- Transfer
- Conference
- Intrusion/Barge-in
- Unconditional call forwarding
- Conditional call forwarding
- Substitution (partial)
- Do not disturb
- DISA
- Text mini-messaging

- Transparency of rotary and DTMF dialing
- Retransmission of last number dialed (redial)
- ISDN/PSTN supplementary services
- Three-party conference
- Six-party casual conference
- 29-party meet me conference
- 29-party moderated (master) conference
- Announcement/paging on speaker

3.2.3 User group features

User group features including busy lamp field (BLF) supervision and DSS (direct station selection) are also available network wide:

- Associate in network
- Immediate call forwarding to associate
- Conditional call forwarding to associate
- Manager/assistant filtering/screening team
- Object supervision: free, partially busy, totally busy, ringing
- Hunting groups

3.2.4 Mobility features

Mobility features of the Alcatel-Lucent OmniPCX Enterprise Communication Server include:

- WLAN
- DECT mobility in network: roaming, user rights, and accounting assigned to home node number

For a DECT wireless handset, roaming is the ability to be located and called anywhere within the area covered by the base stations. When several Alcatel-Lucent OmniPCX Enterprise Communication Server systems are in a private network, the mobile phones must be registered with the "roaming in network" capability, allowing them to be used within the radio coverage area of any Alcatel-Lucent OmniPCX Enterprise Communication Server in the network. The users at the guest node have the same access rights as when located on their home node because of the transparent transmission of class of service and call detail records (for accounting purposes). Roaming also allows voice mail message notification, screening, etc.

- Paging services in network
- Remote call forwarding
- Substitution
- Ubiquity services

3.2.5 Centralized or distributed attendants

Attendants can be centralized or distributed over an ABC network and have access to the following features:

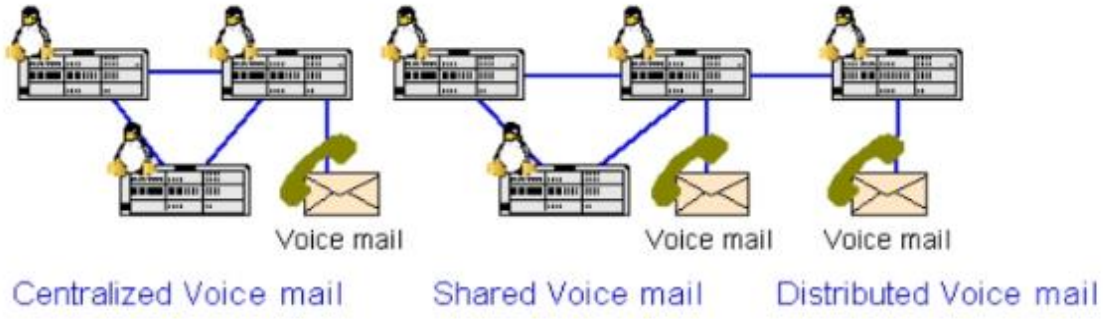
- Basic call
- Number and name identification
- Three-party conferences
- Broker call

- Call by name
- Call distribution for decentralized and centralized attendants
- Call offer
- Chained call
- Class of service identification
- Class of traffic indication on line keys (internal call, external call, overflow)
- Do not disturb override
- Dynamic accesses to user call resources (DECT, voice mail, text mail, etc.)
- Consultation call
- Call hold
- Intrusion/Barge-in
- Large busy lamp field supervision
- Multi-tenant services
- Overflow of unanswered external calls
- Retransmission of last number dialed (redial)
- Routing and services for multi-company multi-department services
- Station reservation
- Text advertising message on busy user display
- Text mini-messaging (Short Message Services)
- Traffic overflow for attendant group or attendants based on caller waiting time
- Transfer with or without presentation
- Transparency in decadic (rotary) and Q.23 (touchtone) dialing
- Trunk allocation with or without outgoing call restriction

3.2.6 Centralized, distributed, or shared voice messaging systems

The voice mail architecture can adopt different configurations:

- The service can be centralized for the entire network (i.e., a single voice mail system can support multiple networked Alcatel-Lucent OmniPCX Enterprise Communication Server systems). This service is available using the:
  - Alcatel-Lucent 4645 Voice Messaging System
  - OpenTouch Message Center
  - OpenTouch Multimedia Services voice messaging
- Multiple voice mail systems (with a maximum 127 external voice mails) can be configured within the network, each shared by a group of Alcatel-Lucent OmniPCX Enterprise Communication Server platforms using the:
  - Alcatel-Lucent 4645 Voice Messaging System. It is possible to network several Alcatel-Lucent 4645 VMS through VPIM
  - OpenTouch Message Center



Regardless of the configuration, to users and network managers, voice mail services are the same as for a single voice mail system.

Note: See the chapter on messaging systems for more details.

The Alcatel-Lucent OmniTouch Unified Communications system is available. See the specific documentation for details on multi-site environments.

3.2.7 Distributed contact center

The distributed Alcatel-Lucent OmniPCX Enterprise Communication Server CCD (contact center distribution) capabilities are layered above Alcatel-Lucent OmniPCX Enterprise Communication Server networking features and therefore are supported in virtually any ABC network configuration. The Alcatel-Lucent OmniPCX Enterprise Communication Server CCD offers two powerful built-in mechanisms for multi-site processing:

- Cooperation between resources situated at different locations. These cooperative facilities offer call routing options for situations in which the service level cannot be guaranteed locally
- Virtual call distribution using the virtual contact center concept, where call-by-call distribution is made to the most appropriate resource regardless of its location

Note: See the Customer services chapter for details about applications in a multi-site environment (including CCx software suite, Web softphones, etc.)

3.2.8 Adaptive routing

On TDM leased lines

Adaptive routing is a powerful routing application that manages call routing in an Alcatel-Lucent OmniPCX Enterprise Communication Server ABC network based on TDM leased lines (T2 or T1 or T0). Adaptive routing is a routing mechanism where the route is calculated before the call is set up. Call setup includes the route to follow, thus avoiding routing in transit nodes.

Each Communication Server integrates the exact topology of the private network at all times and can determine in real time the current route availability and traffic load. The Communication Server immediately selects the best available route based on the load on each link and the number of hops required (transit PBXs) for completing the call.

Adaptive routing provides a high level of security (avoids loops) and link optimization, and avoids performing routing management in the private network.

With adaptive routing, the private numbering (dialing) plan can be distributed throughout the network without requiring any additional management task, (e.g., directory number 56000 on node 1, 56001 on node 2, 56002 on node 1, 56003 on node 4, etc.)

Adaptive routing in ABC-VPN networks (over switched networks)

Adaptive routing on switched networks is different than on fixed leased lines.

The private voice topology through the PSTN network can be "logically" defined by creating "VPN jumps" to link the different nodes to form a fully meshed or partially meshed topology.

Each VPN jump has an associated "cost."

Before a private network call is set up, the routing service selects the best route, which is the route with the computed lowest cost.

3.2.9 Alternate route selection (ARS)

Alternate route selection, sometimes referred to as Least Cost Routing (LCR), is used when a user of an Alcatel-Lucent OmniPCX Enterprise Communication Server system dials an external number (not internal, not private ABC), for example, a public call or private call (tie lines, etc.).

ARS allows the communication server to select trunk groups and modify dialed digits based on a set of parameters such as dialed number, entity of the caller, or time of day.

ARS is used in a standalone or networked configuration for optimizing external telecom call costs.

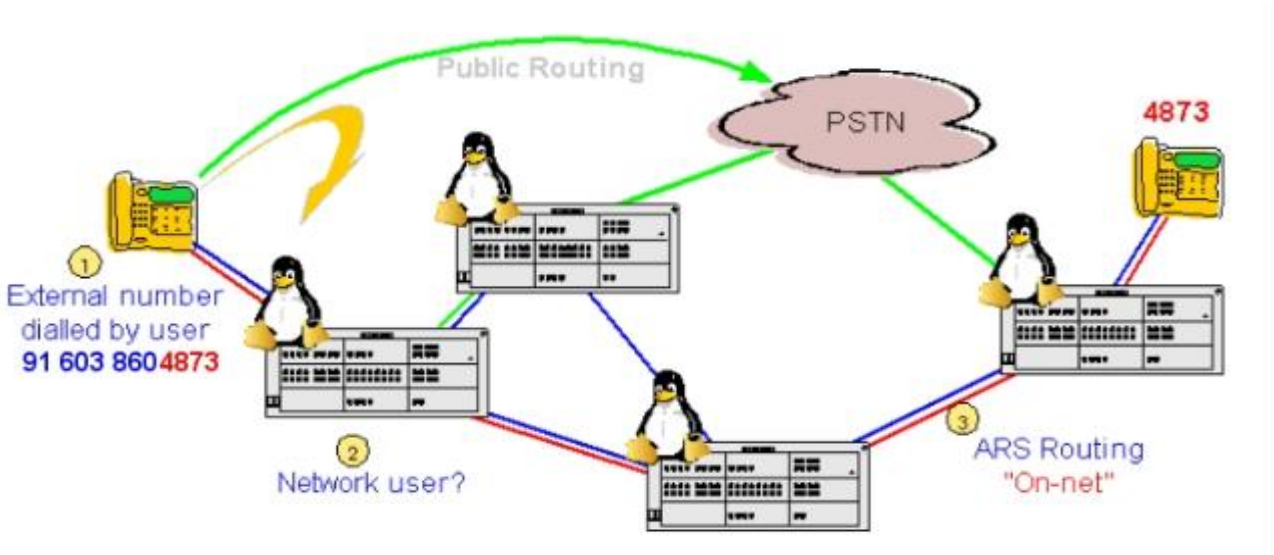
- Direct or indirect multi-carrier access (stand alone, network)
- Forced on net (network)
- Break out (network)

ARS services are transparent to network users. The main characteristics of ARS are:

- 20,000 plus routes (not limited)
- 4,000 route lists
- One to 30 digit numbers analyzed, with management of exceptions
- Number translation (add or delete)
- Overflow to ten different carriers
- Overflow to other carriers according to user's class of service
- Informative voice prompt if user overflows to an expensive route
- Informative voice prompt if least cost route is unavailable
- ARS is time dependent based on:
  - Day of week: 100 weekly tables
  - Hour and minute of the day: five daily tables per weekly table
  - 24 periods per day

Forced on-net routing

The ARS/LCR application built into the Alcatel-Lucent OmniPCX Enterprise Communication Server analyzes the public number dialed before setting up the call (ARS prefix). If the called party belongs to the private network, the ARS application will automatically choose the least costly route (in this case, a private route) and provide ABC feature transparency.



Break out (hop off routing)

When a user calls an external party, the number dialed is analyzed by the ARS/LCR application. Each Alcatel-Lucent OmniPCX Enterprise Communication Server integrates the exact topology of the private network at all times and can determine in real time the current route availability and traffic load (information via the D-channel signaling). The Alcatel-Lucent OmniPCX Enterprise Communication Server transparently selects a route over private infrastructures to make an external call using the PSTN line with the lowest cost.

Multiple carrier selection

When a user calls an external party, the number dialed is analyzed by the ARS application. According to the call direction, the best-priced carrier is selected.

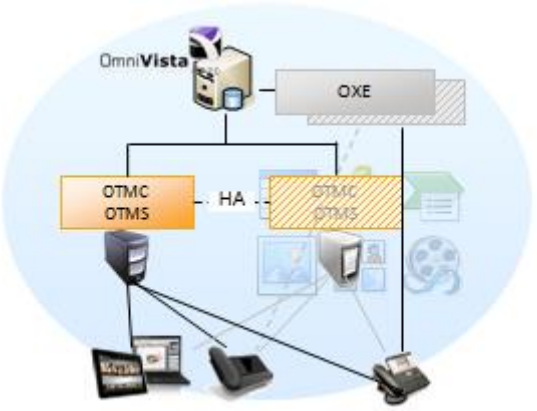
The address information is modified to conform to the carrier's numbering scheme (by adding, removing, or converting digits), and the called number and converted number are stored in the call detail record application.

When the lowest priced carrier for this call is not available (congested), the caller, if so entitled, is diverted to another carrier offering a higher cost. The user is informed of a route change by a voice message. They can hang up and try again later if the call is not urgent, or wait for the call to overflow. At the end of the waiting queue, the call is diverted to the second carrier with the number converted automatically as described above. The ARS application allows ten different carriers to be selected successively.

3.2.10 Management of an ABC network

The ABC management tools are based on PC clients based on a server using Windows OS. They provide a complete set of graphical user interface applications designed to facilitate day-to-day management operations. The management workstations are connected through an Ethernet link to a networked Communication Server. Dialog between the management workstation and the Alcatel-Lucent OmniPCX Enterprise Communication Server is based on standard protocols: FTP, CMIP/CMISE... SNMP is integrated in order to allow network supervision with other company management tools.

Network management can be centralized or distributed.



Configuration broadcast mechanism

The management workstation can manage one, several, or all the nodes in a private Alcatel-Lucent OmniPCX Enterprise Communication Server network. This mechanism does not use any bandwidth on the B channels of the ABC links; only the signaling channel (D channel) is used. A network manager can program or modify any system, station user, or voice mail system parameter from one unique PC client window. The other network nodes and the centralized directory are immediately and automatically informed, and their databases are updated with consistent information.

Audit service

Another management service is the audit service. This service has been designed to facilitate consistent network monitoring, reconfiguration, and evolution and to easily integrate voice mail. After a local configuration change, a new node automatically retrieves the network configuration and updates its database (network translator, phone book, etc.) while the voice mail updates the user database.

Voice mail management

Only one workstation management operation is needed from the administrative station's user management window to configure a user (on any network node) and assign voice mail services (mailbox and user profile). The voice mail system automatically creates a virtual user mailbox in the other network's voice mail system. Each user can then create distribution lists and transfer messages, etc., to the other users in the network as though they were on the same node.

Management: SNMP support on Alcatel-Lucent OmniPCX Enterprise Communication Server

The management of the Alcatel-Lucent OmniPCX Enterprise Communication Server can be integrated with standard network management platforms such as HP OpenView NNM (HP) using Simple Network Management Protocol (SNMP). These network management platforms are referred to as hypervisors.

Hypervisor Integration is a solution to manage converged voice and data enterprise networks. It is particularly well suited for networks with elements from multiple vendors.

Hypervisor integration provides two main features:

- Control of the Global Network: This is a standard, joint offer from the hypervisor provider and Alcatel-Lucent. Customers will use the standard hypervisor (UNICENTER, HPOV, Tivoli, etc.) with only those customizations available through the standard hypervisor capabilities. Control of the global network is provided via an overview of the network (i.e., topology map)

- Topology views may cover every network element and application. Alarm status is indicated by a change in the color of the associated icon. In depth analysis of the alarm status may be conducted, either by using the hypervisor event manager, or by using the proprietary tools designed by the network item provider. Hypervisors do not provide configuration capabilities because this is specifically linked to each network item.
- Specific Alarm Handling: This is a customized solution specifically defined by the customer. The customer will handle all the global network alarms with specific tools created for their help desk organization. This usually requires in-house development by the customer.

Functional options and how they work on the Alcatel-Lucent OmniPCX Enterprise Communication Server

Functionalities vary for each hypervisor. They depend on the generic capabilities of the hypervisor and on the capabilities of the hypervisor agent that are developed by Alcatel-Lucent, partners, or the customer.

Auto-discovery and Topology

The hypervisor uses ping and SNMP Get commands to discover IP components. The hypervisor replies to SNMP Get commands with Alcatel-Lucent-specific object IDs or specific extended attributes allowing for the discovery of Alcatel-Lucent IP components and represented by Alcatel-Lucent specific icons on the topology map.

Hypervisors may poll IP components to get their status and display the related icons with their related colors.

The status of IP components may be obtained by the hypervisor based on answer (green)/no answer (red) or more precisely by using the Alcatel-Lucent-proprietary status attribute (there is no standard status attribute defined in MIB II) or status trap. MIB extensions and hypervisor agent development are required to handle the extended status attribute or status trap functions.

Alarm Handling

Alarms are sent by IP components using SNMP traps. Alcatel-Lucent uses a specific SNMP trap (defined in the SNMP standard) that allows equipment providers to create proprietary alarm traps to notify the hypervisor of alarms.

Security

The customer can define communities. SNMP requests can be done only between hypervisor and OmniPCXs belonging to the same community. The members of one community share the same community name. The community name is sent with each SNMP message and acts as a clear text password. SNMP requests with an unknown community name are rejected. The new SNMPv3:

- Restricts access of MIB information to authenticated hypervisors only. A hypervisor requires a SNMPv3 account (login name and password) declared in the Communication Server configuration. The hypervisor agent, which carries out specific functions (e.g. security), must also be declared. A maximum of 10 SNMPv3 user accounts can be configured on the hypervisor agent
- Provides an encryption process for SNMP Protocol Data Units (PDUs). PDUs can contain address and control information. To cipher the PDUs, a hypervisor must declare a SNMPv3 passphrase in the CS configuration and in the hypervisor agent configuration.

3.2.11 Business continuity in case of Communication Server switch-over

Network established ongoing communications are maintained, even if an IP/ABC Link or hybrid TDM Link is involved in the communication. Thus, business continuity is offered between endpoints (IP Touch, legacy devices/ trunks, SIP devices/trunks, MyIC clients for OpenTouch users, equipment

connected to another Communication Server, through ABC/IP Trunk Group or ABC TDM Links) belonging to different Communication Servers.

- Peer-to-peer communications in conversation state are maintained
- In set-up phase, communications are released except for incoming external communications, which are routed to the relevant entity (e.g. an attendant)
- Conferences are not maintained and communication on hold will be either distributed in function of entity (for external communication) or released
- Communications involving attendant, automated attendant, IVR, voice mail, nomadic are released

The evolution of the communication (from calling party or called party) is not handled during the switch-over (except for hanging up, press the release key, hands-free/ handset switch-over, mute activation/deactivation, level of loudspeaker management). However, at the end of switch-over (new established link between the two Communication Servers), the communication can evolve as before.

For IP and hybrid links, the network communication cannot evolve during the switch-over (40-60 seconds.). Nevertheless, users can:

- Alternate between hands-free / handset
- Mute/ un-mute
- Modify the loudspeaker level
- Release the call (hang-up, press the release key)

The devices are not reachable and are seen out of service during switch-over.

This feature does not require additional new fees and it is compatible with:

- IP Touch Security deployment
- Communication Server spatial redundancy

3.3 Heterogeneous networking

3.3.1 ISVPN (country dependent)

ISDN based VPN (ISVPN) provides an entry level networking solution based on a subset of the ABC private network protocol using only the ISDN network.

No leased line is required for voice or telephone signaling. Voice is transported over the standard public ISDN network, and the signaling transport is based on the USS1 service provided by the ISDN network. The features provided by this service are:

- Distribution of incoming public calls based on virtual DID
- Homogeneous private numbering (dialing) plan
- An ISVPN call is seen as an internal call, not a public call
- Name identification (with transport of number)
- Optimized transfer (loop avoidance and optimized call forwarding)
- Callback request (on Alcatel-Lucent 8/9 series)
- Intrusion/Barge-in
- Other Alcatel-Lucent OmniPCX Enterprise Communication Server features over ISDN without the added value of ISVPN
- Call distribution in network: centralized attendants
- Inter-working with ABC networks
- Centralized management

ISVPN is also supported on the Alcatel-Lucent OmniPCX Office, which is used to build small, simple enterprise/office networks over ISDN.

3.3.2 DPNSS networking

The Alcatel-Lucent OmniPCX Enterprise Communication Server offers a compliant legacy Digital Private Network Signaling System (DPNSS) interface and protocol, mainly used to connect the voice system to:

- DPNSS installed base not compatible with QSIG
- VPN offer of BT (FEATURENET) and Cable & Wireless in UK
- Alternative carriers (e.g., GSM operators in Germany and Sweden)
- Legacy applications

The DPNSS services supported are:

- Voice call (six and seven)
- Callback when free (call completion on busy phone) (nine)
- Intrusion/Barge-in (ten)
- Call forwarding (11)
- Hold (12)
- Inquiry/consultation call (13)
- Transfer (13)
- Conference (13)
- Call offer (14)
- Service independent string (16) name
- Call waiting (17)
- Route optimization (19)
- Centralized night service (25)
- Do not disturb (32)

3.3.3 QSIG

The QSIG protocol provides a very good method for connecting PBXs from multiple vendors. QSIG is an open, international standard supported by the world's leading PBX suppliers. The QSIG protocol is based on ISDN and ensures service compatibility between public and private ISDN networks. QSIG can work in all kinds of topologies, with no limitation on the number of nodes supported and no restrictions on the numbering (dialing) plan.

The Alcatel-Lucent OmniPCX Enterprise Communication Server offers a network interface implementing QSIG-BC (QSIG basic call). QSIG BC (ETS 300 172) is the part of the protocol that describes the basic call and extends the public ISDN access protocol for use in private basic rate access and primary rate access services. As one of the QSIG Forum founders, Alcatel-Lucent supports this standard and is committed to implementing enhancements as the OSI committee makes them standards.

QSIG numbering (dialing) plan

The following numbering plans are supported:

- Heterogeneous numbering plan
- Closed numbering plan
- Open numbering plan (up to 20 digits)

QSIG-BC services

The level of service of QSIG-BC (basic call) is the same as on traditional tie lines with the following advantages:

- Caller and connected party number identification
- Voice call

Accounting

Each outgoing call on the QSIG trunk generates a Call Detail Record (CDR) with the duration of the call.

Interaction between the different systems

An Alcatel-Lucent OmniPCX Enterprise Communication Server user can make a call on a public trunk line located on another PBX through the QSIG-BC interface. In this case, the Alcatel-Lucent OmniPCX Enterprise Communication Server performs external call restriction. In addition, for all incoming QSIG-BC calls, if the party's class of service is sent by the connected PBX, the Alcatel-Lucent OmniPCX Enterprise Communication Server is able to differentiate calls originating from private subscribers and public trunks, and react as follows:

- Calls originating from private networks are treated as internal calls in attendant queues
- Public calls are stored in the unanswered call directory
- For calls coming from the public network through QSIG-BC, a call overflow on no answer or busy user can be processed either by the Alcatel-Lucent OmniPCX Enterprise Communication Server or in the transit network, depending on configuration

QSIG - GF/SS

GF (generic function) and SS (supplementary services) are the service enhancements of QSIG-BC. Additional services have been defined as part of the new standard. Those standards, as soon as they are available, are implemented in the Alcatel-Lucent OmniPCX Enterprise Communication Server proprietary network protocol.

The QSIG-GF provides name identification plus transparent features. QSIG-SS provides telephone services such as:

- Calling line identification presentation
- Connected line identification presentation
- Calling/connected line identification restriction
- Calling name identification presentation
- Connected name identification presentation
- Calling/connected name identification restriction
- Generic functional procedures
- Call forwarding - unconditional
- Call forwarding - busy
- Call forwarding on no answer
- Call transfer
- Path replacement
- Call completion to busy subscriber
- Call completion on no answer
- Call offer
- Advice of charge

- Call intrusion (Barge-in)
- Do not disturb
- Message waiting indication (when the messaging system is the Alcatel-Lucent 4635 or Alcatel-Lucent 4645)

3.3.4 SIP interoperability

The Alcatel-Lucent OmniPCX Enterprise Communication Server and the Alcatel-Lucent OmniPCX Office Communication Server are fully compatible with SIP.

See the chapter on SIP for more information.

3.3.5 OmniMobility voice over wireless LAN

3.3.5.1 WLAN infrastructure

In many business environments, mobility is an ever increasing priority, but the ways in which end-users communicate evolve constantly. Within company premises, end-users get accustomed to comfortable and efficient methods to ensure voice and data communication exchanges. Away from the desks, but still at work, they are entitled to expect the same facilities and services.

Alcatel-Lucent, the leader in wireless voice solutions for the workplace, offers the industry's most advanced Voice over IP (VoIP) service for Wireless LAN (WLAN) networks, namely VoWLAN (Voice over Wireless LAN) or VoIP on WLAN.

To meet corporate user mobility requirements in company premises, Alcatel-Lucent provides a range of VoWLAN solutions for businesses in search of a scalable, secure WLAN network to deliver high performance user access, supporting location tracking applications.

Based on global standards for WLANs, Alcatel-Lucent VoWLAN solutions simplify network infrastructure by allowing converged voice and data traffic over a common wireless broadband (802.11a/b/g/n) network.

3.3.5.1.1 Alcatel-Lucent VoWLAN single infrastructure

The Alcatel-Lucent OmniAccess Wireless platform offers an evolutionary new architecture that delivers mobility, security and convergence for today's networks, leveraging a distributed wireless deployment with centralized control. The centralized architecture concentrates all intelligence in the WLAN controller for increased functionality, manageability and ease of deployment.

The Alcatel-Lucent VoWLAN infrastructure is around three aspects which can be mixed and matched to meet different challenges and customer requirements:

The Alcatel-Lucent OmniAccess WLAN controllers: act as wireless IP switches and provide the connection between the wired LAN and the Alcatel-Lucent OmniAccess WLAN Access Points. .

The family of WLAN controllers delivers a centralized wireless security and management architecture. Alcatel-Lucent offers the most comprehensive line of WLAN controllers that include modular and fixed form factor systems appropriately sized for the small branch office, medium regional headquarters, and large dense building or campus environments. Each system integrates sophisticated features, such as identity-based policy enforcement, ICSA certified firewall, VPN server, intrusion protection and RF management. Hardware-based wireless processing enables Alcatel-Lucent WLAN controllers to deliver industry-leading performance (multi-gigabit encrypted throughput) and scalability. A single system can connect users to an almost unlimited number of access points. Multiple controllers may be teamed to provide both controller redundancy and to increase the system's capacity while retaining a single point of management

The **Alcatel-Lucent OmniAccess WLAN Access Points (APs)**: operate with the OmniAccess WLAN switches to provide a high performance, centrally managed, wireless mobility solution for enterprises. They act as wireless (radio) interfaces for the mobile WLAN handsets.

The Alcatel-Lucent solution offers a wide range of access points to support a variety of 802.11n solutions while also supporting legacy 802.11a/b/g devices. APs are available with both single and dual-radios to support communications in the 2.4 GHz and/or 5 GHz spectrum. Single radio access points can provide 802.11a/n or 802.11b/g/n and may be software configured on a per AP basis. Dual-radio APs support concurrent 802.11a/b/g/n communications to provide the broadest support for WLAN users. All of the APs are thin APs that work in conjunction with OmniAccess WLAN controllers, which automatically manage the operation of each AP, including power/transmit levels and channel assignments. Network traffic is typically tunneled from the APs to WLAN controllers using remote APs. This provides security and makes the solution easy to deploy and modify without making major modifications to the wired LAN. Alcatel-Lucent offers both indoor and outdoor APs

Software – The base system offers a fully functional and manageable platform capable of a wide range of functionality. Systems are licensed and sized by the number of APs to be supported up to the hardware's maximum with LAP licenses. With only the base access point software the systems support the full functionality web management interface, master-local teaming to unify the management of multiple controllers through a single point of management, captive portal authentication, WEP, WPA, WPA2, 802.1x, certificate based authentication, rogue detection, mesh functionality and remote AP functionality with encrypted IPSec tunneling back to the controller just to mention a subset of the system's functionality.

PEFV – The Policy Enforcement Firewall / VPN software module enables the controller as a VPN concentrator for IPSec clients or tunnel connections to other controllers or hardware platforms. It will also enable firewall policies to be applied to the traffic reaching the controller via these tunnels. This license is controller wide and not determined by the quantity of supported APs.

PEFNG – The Policy Enforcement Firewall / Next Generation license enables the firewall policies to be applied to WLAN traffic or wired traffic received by the controller. This software also enables QoS and VoWLAN applications on the controller. PEFNG is licensed by AP and must match the number of LAP licenses applied to the controller.

XSC – The XSC or xSEC license enables the controller to encrypt user traffic with 256-bit AES encryption. All other encryption types are available in the base software. The XSC license is based on a per-session basis and must be sized at or above the maximum number of concurrent sessions on the controller.

RFP – The RF Protect software module includes advanced RF analysis to be performed from the APs and provides wireless intrusion detection and protection for a wide variety of known attacks and security vulnerabilities. The RFP license is based on the number of APs supported by the controller and must match the quantity of APs provisioned under the LAP license.

The last software option available is the OmniVista 3600 Air Manager. The OV-3600 can be used in conjunction with the Alcatel-Lucent OmniAccess WLAN platform to enhance the system's manageability or can work with a third party product to assist in system migration or to manage a heterogeneous wireless environment.

The OV-3600 is the only network management software to deliver a single, easy-to-use console that gives the entire IT staff full visibility and control over their wireless network and its users. Network engineers, helpdesk staff, IT managers and security analysts at more than 650 enterprises and large organizations use the OmniVista 3600 Air Manager technology (under the Airwave brand) to make their wireless networks supportable, reliable, and secure.

The OmniVista 3600 Air Manager supports wireless equipment from seventeen different vendors, including Alcatel-Lucent, Aruba Networks, Cisco, Symbol/Motorola, Trapeze, Meru, HP ProCurve, Nortel, Proxim, Foundry, Colubris, Tropos, 3com, Enterasys, Juniper, Lancom, and Avaya.

The Alcatel-Lucent WLAN solutions support up to 512 access points per Supervisor Card 3 and up to 2048 access points on a single WLAN switch chassis (with 4 supervisor card 3), centralized encryption for 802.11i, advanced intrusion detection and protection capabilities, and offer user-aware fully operational firewalls.

Key benefits

Reduced Wireless Operating Costs

- Lowers user support costs by giving the Help Desk effective diagnostic tools
- Helps IT extend the useful life of existing WLAN infrastructure
- Automates routine tasks like configuration, software updates, and compliance audits
- Provides reports to facilitate capacity planning and efficient technology upgrades

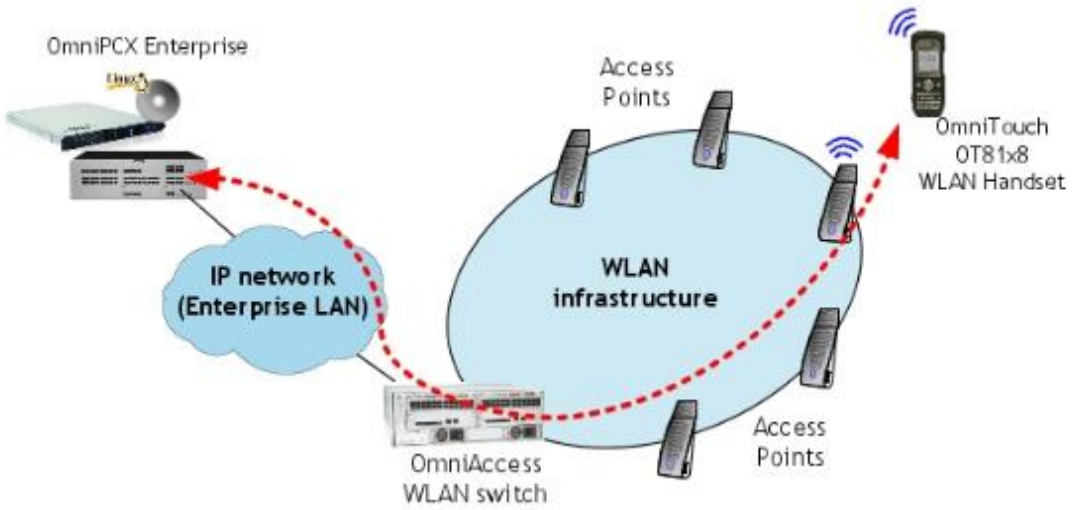
Improved Performance and Reliability

- Automates performance diagnostics and implements corrective actions
- Provides a complete reporting package that helps IT identify bottlenecks and problem areas
- Eliminates configuration errors that impact performance
- Enables rapid, remote problem resolution

Improved Network Security

- Enforces consistent configuration and security policies across the entire organization
- Detects unauthorized rogue access points
- Automates configuration compliance audits
- Provides role-based administrative access and complete audit logs • Allows IT to see every user on the network

To complete the VoWLAN offer, Alcatel-Lucent provides a line of professional WLAN handsets fully compatible with the OmniPCX Enterprise services.



Controlling access points

From a system capacity perspective, a single WLAN controller can connect tens of thousands of simultaneous users to thousands of access points. Because the Alcatel-Lucent OmniAccess 6000 is modular, it can easily scale to accommodate increased capacity. Simply adding a new Supervisor-III module can scale a platform to handle an additional 512 Access Points. The 6000 controller can

support up to four Supervisor-III modules for a total of 2,048 APs. If the system needs to grow larger than this multiple controllers can be teamed to work together as a master-local grouping. In this case many controllers may work together as a cohesive system with a single point of management. Deployments of over 1,000 APs will at times use a dedicated master controller which will support no AP connections but be dedicated to system management.

Load balancing

Access Point load balancing is available to intelligently allow the system to balance wireless traffic across adjacent APs. Load balancing can be triggered based on the number of users or degree of utilization on an AP. When traffic reaches the configured thresholds on an AP where load balancing is allowed, any new wireless client station attempting to associate with the saturated AP will be directed to an adjacent AP instead. Stations which are already associated with the AP are not affected.

For Alcatel-Lucent Access Points, load balancing is implemented by station management on the OmniAccess WLAN controller and is entirely standards based. This avoids any client driver changes to be made and allows the solution to operate transparently to end users. Bandwidth contracts can be used to constrain the bandwidth per user to help maintain acceptable network performance. Bandwidth is specified using a kbits|mbits parameter. The contract can be implemented so that all the users within the assigned role on a given AP share the bandwidth or per-user where each user in the role receives the entire bandwidth specified by the bandwidth contract.

Load-balancing is used to enhance the OmniAccess Wireless Call Admission Control (CAC) function by limiting the number of voice calls per AP. CAC statefully follows voice signaling protocols allowing it to count the number of active calls per AP and trigger load-balancing.

3.3.5.1.2 Alcatel-Lucent VoWLAN product lines

The OmniAccess wireless product family is based on a centralized architecture with light access points, and embedded security.

One of the key challenges of mobility is security. The OmniAccess wireless product family embeds identity based security, WLAN intrusion prevention, endpoint integrity and content inspection services.

Alcatel-Lucent VoWLAN products offer:

A line of OmniAccess WLAN switches, namely:

OAW-4306G Used to support: • Up to 16 AP • Up to 64 RAP • Up to 512 users Equipped with two 10/100/1000 Gigabit Ethernet ports, four 10/100/1000 POE+ Gigabit Ethernet ports, two Gigabit SFP ports, four USB ports and one ExpressCard slot for flexible LAN applications. Embedded Stateful Inspection firewall options.	 **OAW-4306G**
OAW-4504XM, 4604 & 4704 Equipped with dual personality ports : - four 10/100/1000BASE-T (RJ-45) or four 1000BASE-X (SFP)	

OAW-4504XM:

- Up to 32 AP (LAN Connected)
- Up to 128 Remote AP/Mesh AP
- Up to 2048 users

Warning: Legacy OAW-4504 is not supported anymore with AOS-W 6.2

The last supported version on 4504 is AOS-W 6.1

OAW-4504XM is supported only with AOS-W 6.2 and later versions

OAW-4604:

- Up to 64 AP (LAN Connected)
- Up to 256 Remote AP/Mesh AP
- Up to 4096 users

OAW-4704:

- Up to 128 AP (LAN Connected)
- Up to 512 Remote AP/Mesh AP
- Up to 8192 users

Embedded Stateful Inspection firewall options allow for robust security solutions.

OAW-4504XM

OAW-4604

OAW-4704

OAW-4550, 4650 & 4750

802.11ac support

- Four 10GBASE-X (SFP+) ports
- Two dual-media ports (1000BASE-X or 10/100/1000BASE-T)
- One USB 2.0
- Console (RS-232) RJ-45 or mini-USB
- LINK/ACT and status LEDs
- Management/status LEDs
- LCD panel and navigation buttons
- Expansion slot (reserved for future use)

Minimum AOS-W 6.2.0 to support OAW-4x50

OAW-4550:

- Up to 512 AP (Campus AP)
- Up to 512 Remote AP
- Up to 16384 concurrent devices

OAW-4650:

OAW-4550

OAW-4650

OAW-4750

• Up to 1024 AP (Campus AP) • Up to 1024 Remote AP • Up to 24576 concurrent devices OAW-4750: • Up to 2048 AP (Campus AP) • Up to 2048 Remote AP • Up to 32768 concurrent devices Embedded Stateful Inspection firewall options allow for robust security solutions.	

A line of OmniAccess WLAN Access Points (APs) designed to address the needs of enterprise wireless LAN deployments. APs include single and dual-radio 802.11a/b/g/n models with a variety of fixed and detachable antenna options.

APs are small, lightweight and can be securely attached in a variety of locations: on walls, in cubicles, on desktops and the ceiling. The AP antenna diversity allows for the best signal processing using dual, omnidirectional antennas.

APs work with all of the OmniAccess 43xx/4x04/6000 series WLAN switches to provide a high performance, centrally managed, wireless mobility solution for enterprises. APs have an extended lifespan because they can automatically configure themselves across any L2/L3 network using a discovery protocol, allowing easy upgrades when new features, capabilities, or standards emerge.

OAW-AP175 Dual-Radio IEEE 802.11n (Outdoor) • 802.11a/n and b/g/n • 2x2 MIMO (two spatial streams) Quad, N-type female interfaces (2 x 2.4 GHz, 2 x 5 GHz) for external antenna support (supports MIMO) 1 x 100/1000Base-T Ethernet port (auto sensing link speed and MDI/MDX) Power: • AP-175P: 48-volt DC 802.3at power over Ethernet (PoE+) • AP-175AC: 100-240 volt AC from external AC power source • AP-175DC: 12-48 volt DC from external DC power source Maximum power consumption is 15 watts	 **OAW-AP175**
OAW-AP104 & AP105 Minimum AOS-W 6.1.3.0 to support AP104 Dual Radio (Indoor) 802.11a/n and b/g/n 2x2 MIMO (two spatial stream)	

OAW-AP104: 4 x RP-SMA antenna interface connectors for external antenna support (2 per band) OAW-AP105: 4 x integrated, omnidirectional antenna elements (supporting 2x2 MIMO). 1 x 100/1000Base-T Ethernet port 12 V DC for external AC-supplied power	OAW-AP104	OAW-AP105

A line of OmniAccess instant WLAN Access Points (IAPs) based on virtual Controller, Each IAP is eligible to become Virtual Controller.

OAW-IAP175 *Minimum AOS-W 6.1.4-3.0.0.0 to support IAP175* Dual-Radio IEEE 802.11n (Outdoor) • 802.11a/n and b/g/n • 2x2 MIMO (two spatial streams) Quad, N-type female interfaces (2 x 2.4 GHz, 2 x 5 GHz) for external antenna support (supports MIMO) 1 x 100/1000Base-T Ethernet port (auto sensing link speed and MDI/MDX) OAW-IAP175P: 48-volt DC 802.3at power over Ethernet (PoE+) OAW-IAP175AC: 100-240 volt AC from external AC power source	 **OAW-IAP175**
OAW-AP274/2755 Dual-Radio (Outdoor) 802.11ac and b/g/n OAW-AP274 (& OAW-IAP274): 2.4-GHz and 5-GHz radios, each with 3x3 MIMO and three combined, diplexed external antenna connectors OAW-AP275 (& OAW-IAP275): 2.4-GHz and 5-GHz radios, each with 3x3 MIMO and three integrated omnidirectional antennas 1 port 10/100/1000Base-T Ethernet network interface RJ-45 Maximum power consumption: 23 W • Direct AC source: 100 V to 240 V AC • Power over Ethernet (PoE): 48 V DC (nominal) 802.3at-compliant source	 **OAW-AP274/275**
OAW-IAP134 & 135	

• 802.11a/n and b/g/n • 3x3 MIMO (3 spatial streams) up to 450Mbps (HT40) Interface: 2 x 10/100/1000Base-T (RJ-45) Ethernet interface (Power over Ethernet) OAW-IAP134: support for selectable 802.11 b/g/n or 802.11 a/n operations, 3x3 MIMO dual-band RP-SMA detachable antenna interfaces. OAW-IAP135: same features as AP134 but with embedded 3x3 MIMO dual-band antennas.	 OAW-IAP134 OAW-IAP135
OAW-IAP105 • Dual Radio (Indoor) • 802.11a/n and b/g/n • 2x2 MIMO (two spatial stream) 4 x integrated, omnidirectional antenna elements (supporting up to 2x2 MIMO with spatial diversity) providing up to 300 Mbps data rate per radio 1 x 100/1000Base-T Ethernet port 12 V DC for external AC-supplied power	 OAW-IAP105

A line of Remote Access Points to complement coverage needs.

OAW-RAP3WN/P *Minimum version to support RAP3WN: AOS-W 6.1.4.0 or Instant OS 3.0.0.0* • Single Radio Single Band (2.4GHz only) • 802.11b/g/n only 2x2 MIMO with two spatial streams and up to 300 Mbps Two integrated, omnidirectional antenna elements for 2x2 MIMO • Antenna gain: 2.0 dBi Interfaces: • E0 (WAN): One 10/100BASE-T Ethernet (RJ-45), auto-sensing link speed and MDI/MDX • E1-E2 (LAN): Two 10/100BASE-T Ethernet (RJ-45), auto-sensing link speed and MDI/MDX • RAP3WNP only: 802.3af PoE (15.4 watts) on the E2 port for IP phones and other equipment	 OAW-RAP3WN/P

<table>
<tr>
<td>OAW-RAP108 & OAW-RAP109
Minimum version to support RAP10x : AOS-W 6.2.0 or Instant OS 3.2.0.0
Dual Radio (Indoor)
• 802.11a/n and b/g/n
• 2x2 MIMO (two spatial stream) , 300Mbps
• Instant or controller-managed
• Two 2.4-GHz and 5-GHz radios,
• 2x2 MIMO, 300 Mbps
• One Gigabit Ethernet uplink, one 10/100BASE-T port, one USB port

OAW-RAP108: Two RP-SMA connectors for external dual-band antennas

OAW-RAP109: Four integrated omnidirectional antennas for 2x2 MIMO with maximum antenna gain of 3.0 dBi in both 2.4 GHz and 5 GHz. Built-in antennas are optimized for vertical orientation</td>
<td>
OAW-RAP108

OAW-RAP109</td>
</tr>
<tr>
<td>OAW-RAP155/P
Minimum version to support RAP10x : AOS-W 6.3.0.0 or Instant OS 3.3.0.0
• Dual radio, dual-band 802.11n indoor
• Software-configurable dual radio supports 2.4 GHz & 5 GHz
• 2x2 MIMO with two spatial streams and up to 300 Mbps wireless data rate in 2.4 GHz
• 3x3 MIMO with three spatial streams and up to 450 Mbps wireless data rate in 5 GHz
Interfaces
• ENET0 (uplink): One 10/100/1000BASE-T Ethernet (RJ-45),
• auto-sensing link speed and MDI/MDX
• ENET1-4 (local): Four 10/100/1000BASE-T Ethernet (RJ-45),
• auto-sensing link speed and MDI/MDX
• ENET1 and ENET2 capable of sourcing PoE power (RAP-155P only)</td>
<td>
OAW-RAP155/P</td>
</tr>
</table>

Alcatel-Lucent completes the WLAN offer with a line of professional WLAN handsets.

3.3.5.1.3 Cisco compatibility

The Alcatel-Lucent OmniTouch 8118/8128 WLAN Handsets can be included in a Cisco WLAN environment.

Wireless switches and access points are provided by Cisco, WLAN handsets and the Communication Server are provided by Alcatel-Lucent Enterprise.

Alcatel-Lucent OmniTouch 8118/8128 WLAN Handsets are compliant with the CCXv2 Cisco proprietary standard.

3.3.5.1.4 LAN standards and certifications

The Alcatel-Lucent OmniAccess Wireless system is Wi-Fi Alliance certified for 802.11a/b/g/n.

For a list of compliant WLAN controller/Access Point combinations and associated certification IDs, please refer to the following website:

- http://certifications.wi-fi.org/wbcs_certified_products.php

The Alcatel-Lucent OmniAccess Wireless system is Wi-Fi Alliance certified for WPA and WPA2 (personal and enterprise).

Terms and Definitions

Campus / LAN: network	A topology where: There is no restriction in terms of bandwidth All IP components (Alcatel-Lucent OmniTouch 8118/8128 WLAN Handsets, IP Phones, CS, MG, …) are located on the same LAN/MAN network (L2 or L3) All IP components (Alcatel-Lucent OmniTouch 8118/8128 WLAN Handsets, IP Phones, CS, MG, …) can be located on the same geographical site or on several sites
WAN / multi-sites: network	A topology where: There is some restriction in terms of bandwidth between sites All IP components (Alcatel-Lucent OmniTouch 8118/8128 WLAN Handsets, IP Phones, CS, MG, …) are located in different IP subnet (in function of topology) All IP components (Alcatel-Lucent OmniTouch 8118/8128 WLAN Handsets, IP Phones, CS, MG, …) are located in different geographical sites (HQ, regional sites and Branch Offices)
Single CS	IPPBX based on an OmniPCX solution with a primary Communication Server and (optionally) secondary Communication Server
Multi-CS	IPPBX based on OmniPCX solution with Communication Servers interconnected via ABC-F2 protocol
IP domain	OmniPCX function used in multi-sites configuration to limit the number of simultaneous voice communications with the users belonging to a site (Call Admission Control – CAC) Define a voice compression/coding algorithm for the extra domain (site) communications (recommendation: G729) and a voice compression / coding for the intra domain (site) communications (recommendation: G711).

	Generally, in Campus / LAN architecture, IP domains are not used because: There is no IP bandwidth restriction; so, it is not necessary to limit the number of communications between 2 locations G711 algorithm is used to code the Voice over IP flows
Roaming	Refers to the ability to be reached (i.e.: making and receiving calls) in a different Site or Network. Inside a site or a network, roaming provides a wireless device the capability to associate to an AP after a power-on or a reset of this device.
Handover	Refers to the ability to move from one AP coverage area to another AP without service disruption or loss in connectivity.
VLANs	These can be used to segment the IP network logically (e.g. voice and data segmentation) Generally, one VLAN ID is associated to one IP subnet. It is recommended to create: One voice VLAN for IP Phones, WLAN phone sets, IP Media Gateways One data VLAN for WLAN laptops and desktops One VLAN for signaling between WLAN switches (used when tunneling is necessary between WLAN switches and a routing function is required) As in a traditional data infrastructure, all WLAN switches and Access Points can be managed in several IP subnets Note: For a large quantity of WLAN phone sets Alcatel-Lucent recommends segmentation into several Voice VLANs

3.3.5.2 VoWLAN communication services and features

3.3.5.2.1 Access to the Alcatel-Lucent OmniPCX Enterprise Communication Server services

OmniTouch WLAN Handsets are fully integrated in the Alcatel-Lucent OmniPCX Enterprise Communication Server and offer a set of communication services. Available during conversations or from the idle state, these services are easily activated to improve the communication capabilities in business environments.

The Alcatel-Lucent OmniTouch 8118/8128 WLAN Handsets use the Alcatel-Lucent New Office Environment (NOE) protocol, are fully compatible with the Alcatel-Lucent OmniPCX Enterprise Communication Server and access services transparently.

Note 1: For current OmniTouch 8118/8128 WLAN Handset details and specifications see Mobile Telephones

During conversation, menus can be used to activate current IP phone call capabilities such as:

- Consultation call
- Broker call/Three-party conference
- Transfer
- Activation of one programmable key

- Callback request

When the phone is not in active use, menus are available to deal with working requirements to manage:

- Call forwarding
- Last caller callback
- Last number redial
- Call pickup
- Waiting call consultation
- Call Park/Retrieve
- Do not disturb
- Wake up/Appointment reminders
- Room status management
- Suite Wake up (hotel configuration)
- Password modification
- Meet me conference call organization
- Hunting group participation
- Voice mail consultation
- Business account code management
- Associated Set modification

Note 2: The preceding lists are not exhaustive. For more details see the OmniPCX Enterprise Communication Server feature list.

Messaging example

Messages are indicated with the presence of an envelope icon.

By using the Menu button, Messaging can be selected. In this example, one voice mail message and one callback request are present. When the personal code is validated access to the messages is granted.

3.3.5.2.2 Quality of Service (QoS)

On a converged network, voice packets must be identified and prioritized to avoid any voice service degradation due to simultaneous data traffic. To ensure excellent voice quality, Alcatel-Lucent's offer uses VMM prioritization mechanism between Alcatel-Lucent Omni Access WLAN infrastructure and OmniTouch 8118/8128 WLAN Handset to ensure voice quality on an Alcatel-Lucent wireless converged network.

WLAN QoS is performed by the Alcatel-Lucent OmniPCX Enterprise Communication Server and the WLAN Controller, provided all the WLAN handsets are OmniTouch 8118/8128 WLAN Handset.

Configuration using WLAN infra

The Alcatel-Lucent OmniTouch 8118/8128 WLAN Handsets support Wi-Fi MultiMedia (WMM), U-APSD, and Tspec for QoS features.

- In-call battery life is improved using U-APSD mode

Configuration with Cisco switches

In a Cisco environment, QoS is provided by switches and APs.

Switches and APs provide priority queuing for voice packets and AP access control.

3.3.5.2.3 Call Admission Control (CAC) and Wi-Fi CAC

The Communication Server performs Call Admission Control (CAC) to manage simultaneous communications in a multi-site environment, in order to avoid tromboning and bandwidth issues on the WAN.

CAC is performed by the WLAN switch: CAC parameters are defined per switch/AP group. Wi-Fi___33 CAC parameters are based on the maximum number of calls per AP or on the usable bandwidth per AP.

In order to avoid bandwidth issues on APs, CAC (Call Admission Control) limits the number of voice calls using the same AP.

3.3.5.2.4 Security

Several security levels can be implemented to authenticate OmniTouch 8118/8128 WLAN Handsets (from lowest to highest level):

- Open System: no protection. Everybody can connect to the system. This solution is used for public hotspot.
- WEP: authentication is based on a key shared by the switch and handsets. Data encryption is based on the RC4 algorithm (Currently considered as not-secured)
- WPA: authentication is based on a key shared by the switch and handsets. Data encryption is based on the TKIP algorithm
- WPA2-PSK (also named WPA2-Home): authentication is based on a key shared by the switch and handsets. Data encryption is based on the AES algorithm.
- WPA2-Enterprise: a radius server (compliant with the IEEE 802.11i standard) is used for authentication. Two authentications methods can be used:
    - EAP-Fast: Mutual authentication is based on a shared secret
    - PEAP/MSCHAPv2: Radius Server authentication is based on a certificate
    - EAP-TLS: Mutual authentication based on certificates

  Since authentication is required for each AP association, roaming between APs generates voice breaks due to re-authentication duration. The fast handoff feature limits the break time. After a first authentication with the radius server, re-authentications due to AP roaming are simplified, data stored in switches and APs are used and the radius server does not need to be reached.

There are two fast handoff methods:

- OKC (Opportunistic Key Caching): a standard method specified in the 802.11i standard
- CCKM (Cisco Centralized Key Management): a Cisco-proprietary fast AP handoff method, only supported on Cisco APs

3.3.5.2.5 DSCP tagging

Packets (voice and data) over the WLAN infrastructure carry their own priority in a DSCP tag. Switches use this tag to process packets with the highest priority level first.

OmniTouch 8118/8128 WLAN Handsets and Communication Servers tag voice packets to the highest priority.

Typically, the priority level is set to:

- Voice packets: 48 (DSCP value set directly by the OmniTouch 8118/8128 WLAN Handset)
- Video packets: 46
- Best effort packets: 0

- Data packets: 0

3.3.5.2.6 Compression algorithm

G711 and G729A:

Multi-Site configuration (one Communication Server):

- G711 in Intra-domain and G729A in Inter-Domain (WAN)

Multi-Node Configuration:

- G711 in Intra-Node and G729A in Inter-Node (WAN)

3.3.5.2.7 Survivability

DHCP

OmniTouch 8118/8128 WLAN Handsets need IP parameters to operate. When handsets are configured to acquire IP parameters from a DHCP server, they send a DHCP request message at each power on.

- If a DHCP server answers, the handset stores IP parameters in its flash memory
- If no DHCP server answers after several attempts, the handset tries to use IP parameters previously stored in its flash memory.

The handset checks if the previous leased IP parameters are not reused:

- If IP parameters are not reused, the handset declares these parameters as valid and uses them
- If IP parameters are reused by another host, the handset tries new DHCP requests until it discovers an available DHCP server

TFTP server

OmniTouch 8118/8128 WLAN Handsets need their configuration files to operate. This configuration file is downloaded from the primary TFTP server hosted in the Main Communication Server or from the redundant TFTP server hosted in the Standby Communication Server when the primary TFTP server is not available.

When no TFTP server is available, the handset tries to connect to the PCS (Passive Communication Server) with the IP address stored in its flash memory.

When all these attempts fail, the handset reboots and tries again.

3.3.5.2.8 Localization service

The WLAN infrastructure can include an Ekahau Real Time Localization System (RTLS). This system periodically receives localization Wi-Fi information from handsets.

The Ekahau Positioning Engine uses the WLAN network topology to calculate the location of the mobile devices.

At a configurable interval, the Alcatel-Lucent OmniTouch 8128 WLAN Handset scans the environment for access points. All access point identities and their measured radio field strength (RSSI) are collected and reported to the positioning engine

The Ekahau Positioning Engine calculates the location of the Alcatel-Lucent OmniTouch 8128 WLAN Handset by using the RSSI measurements to triangulate the mobile devices within the WLAN environment, as soon as the access point report is received.

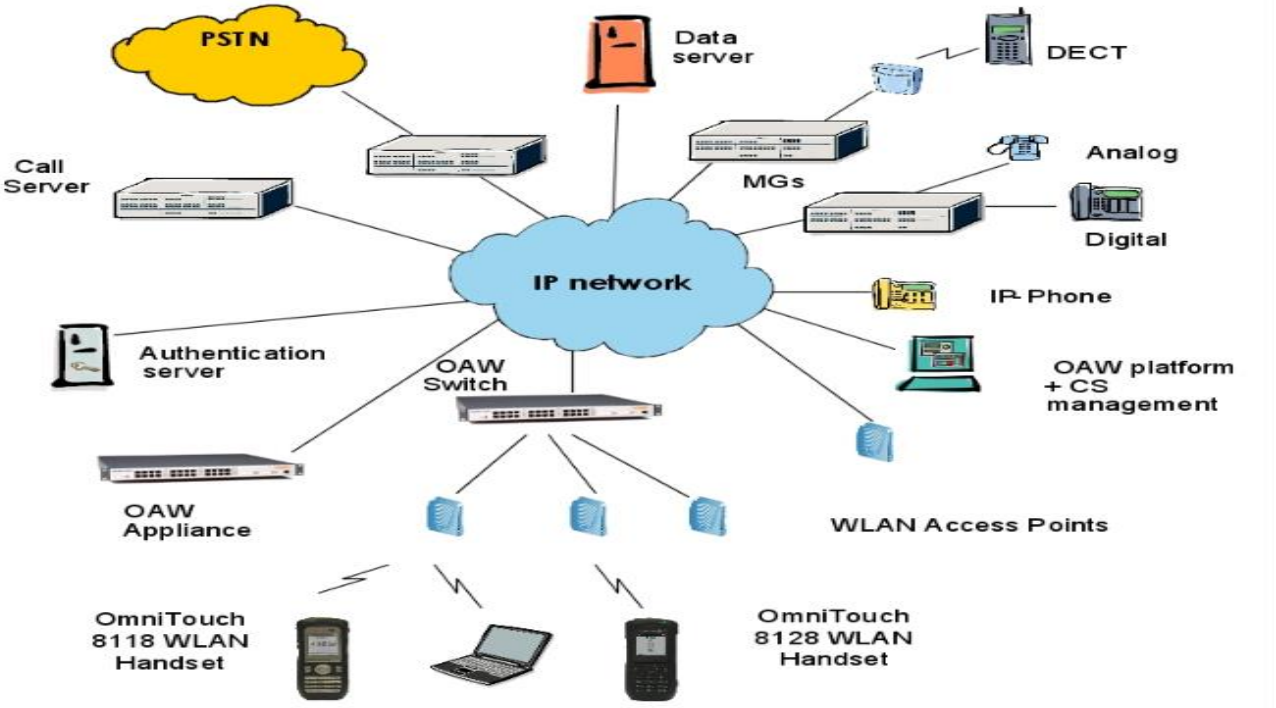
Note: This service is **only** available on Alcatel-Lucent OmniTouch 8128 WLAN Handsets.

3.3.5.3 Topology and architecture

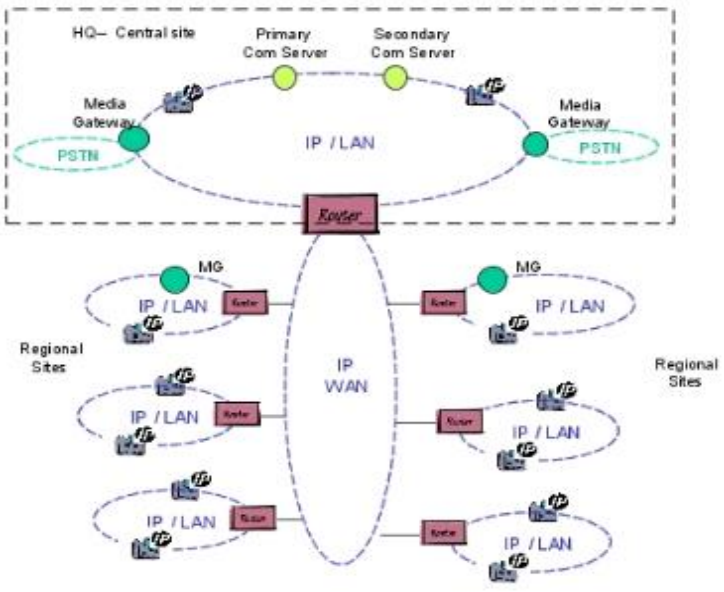
3.3.5.3.1 Global architecture

An Alcatel-Lucent OmniPCX Enterprise Communication Server can handle different types of sets connected through IP:

- Legacy sets behind an IP Media Gateway (e.g. analog, DECT, Alcatel-Lucent sets)
- IP Phone sets (e.g. IP Touch hard-phone, soft-phone)
- Alcatel-Lucent OmniTouch 8118/8128 WLAN Handsets



Example of VoIP architecture

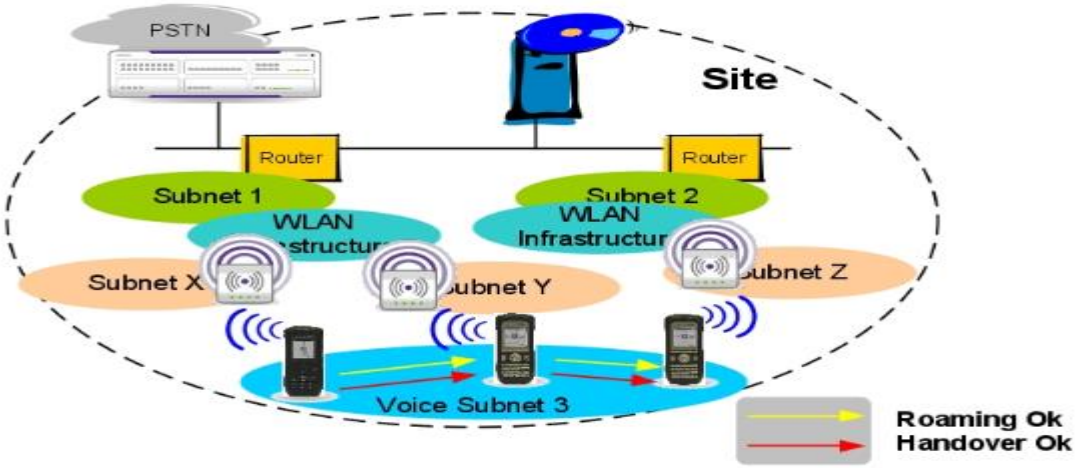


In the following sections some architecture examples are described to demonstrate VoWLAN solutions that can be implemented.

3.3.5.3.2 VoWLAN topology and architecture examples

Campus – LAN – single communication server architecture

The Alcatel-Lucent VoWLAN solution can be deployed in a single site environment regardless of the data network architecture. User roaming and handover are possible even if the data network is segmented at Layer 2 or 3. Access Points, as OmniTouch 8118/8128 WLAN Handsets, can belong to different IP sub-networks.



The Alcatel-Lucent solution offers an inter-Wireless switch and Inter IP Sub-network mobility.

The OmniPCX Enterprise Communication Server can handle up to 15,000 sets.

In this architecture, communications are coded with the G711 algorithm to favor the voice audio quality.

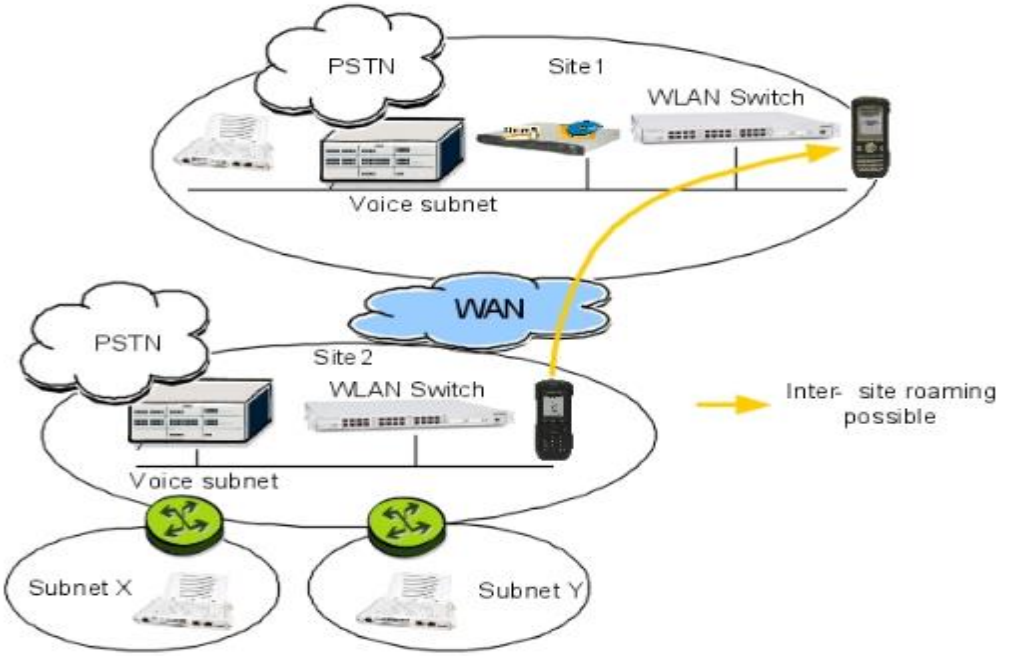
Multi-site – WAN – single Communication server architecture

The Alcatel-Lucent VoWLAN solution can be deployed in a multi-site environment, even if the call processing function (Communication Server) is centralized on one site.

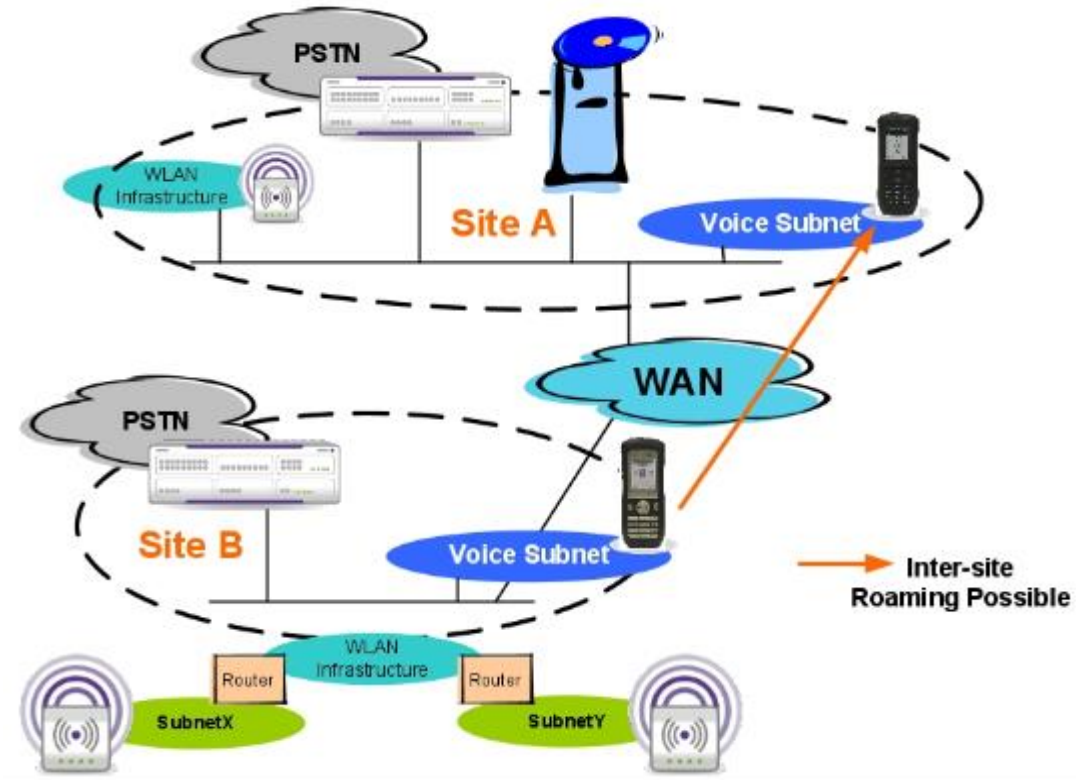
Generally, the bandwidth is limited on the WAN connecting the remote site. This means that the number of simultaneous communications with other sites must be configured. The central Communication Server performs the Call Admission Control (CAC). When an OmniTouch 8118/8128 WLAN Handset changes sites, its IP address changes automatically. So, the handset is automatically located in the corresponding IP domain allowing the Communication Server to control CAC correctly.

User roaming is possible between sites, provided the CAC limits for access points are not reached.

At least one Wireless LAN Switch is mandatory on each site.



In a multi-site topology interconnected by WAN (limited bandwidth), at least one Wireless LAN switch is mandatory on each site.



In general, communications are coded with:

- The G711 algorithm on a given a site, to favor voice audio quality
- The G729 algorithm between sites, to favor bandwidth

If G729 is used for OmniTouch 8118/8128 WLAN Handset communications, all communications (including other IP Touch phones) will use this compression algorithm.

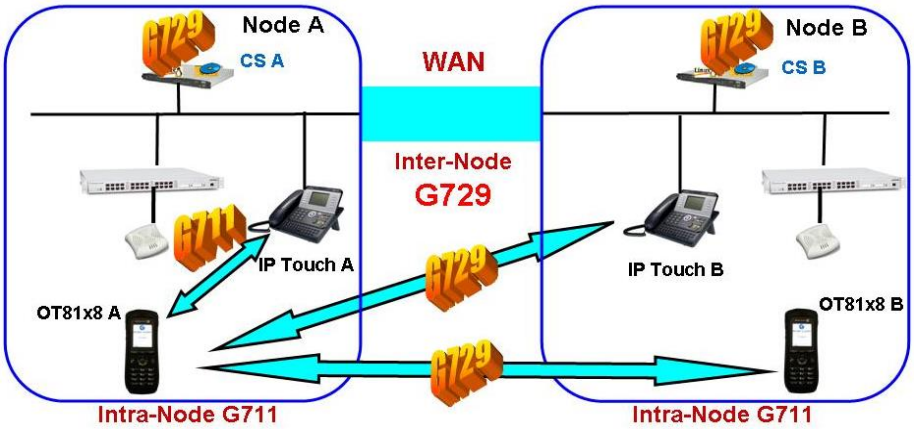
Direct RTP in an inter-site architecture

With the introduction of Direct RTP and the NOE protocol for the OmniTouch 8118/8128 WLAN Handset, calls are treated more economically on an inter-site basis.

The following diagrams indicate the call progression from OmniTouch 8118/8128 WLAN Handset A to OmniTouch 8118/8128 WLAN Handset B via the WAN without compression/decompression.

- IP domains are used to perform CAC control on the WAN
- G711 in Intra-domain (Sites A & B)
- G729A in Extra-domain (WAN)

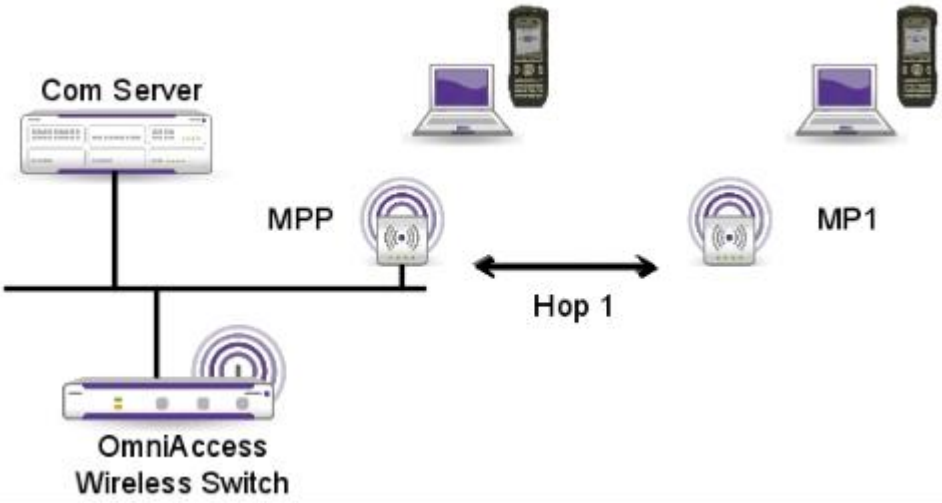
The call is treated as RTP traffic between the Alcatel-Lucent OmniTouch 8118/8128 WLAN Handsets A and B.



3.3.5.3.3 Mesh access point topologies

A mesh is a WLAN network where an access point is linked to another AP in order to extend Wi-Fi coverage (backhauling) or to extend a LAN (mesh bridging).

Mesh backhauling

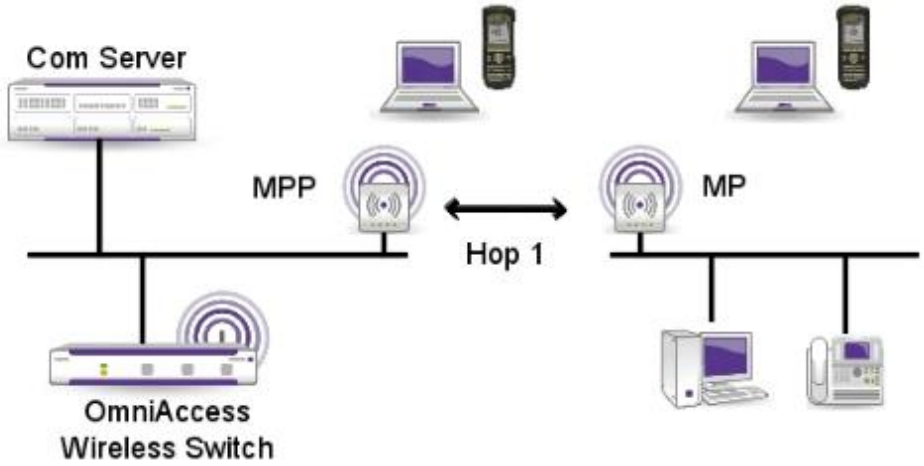


This topology, which is a basic backhauling configuration, includes two kinds of Access Points (AP):

- **Mesh point** (MP): this AP is connected to the mesh portal via a wireless link.

- **Mesh PORTAL** (MPP): this AP is connected to the OmniAccess Wireless switch via a wired link. This mesh portal may connect WLAN clients.

Mesh bridging



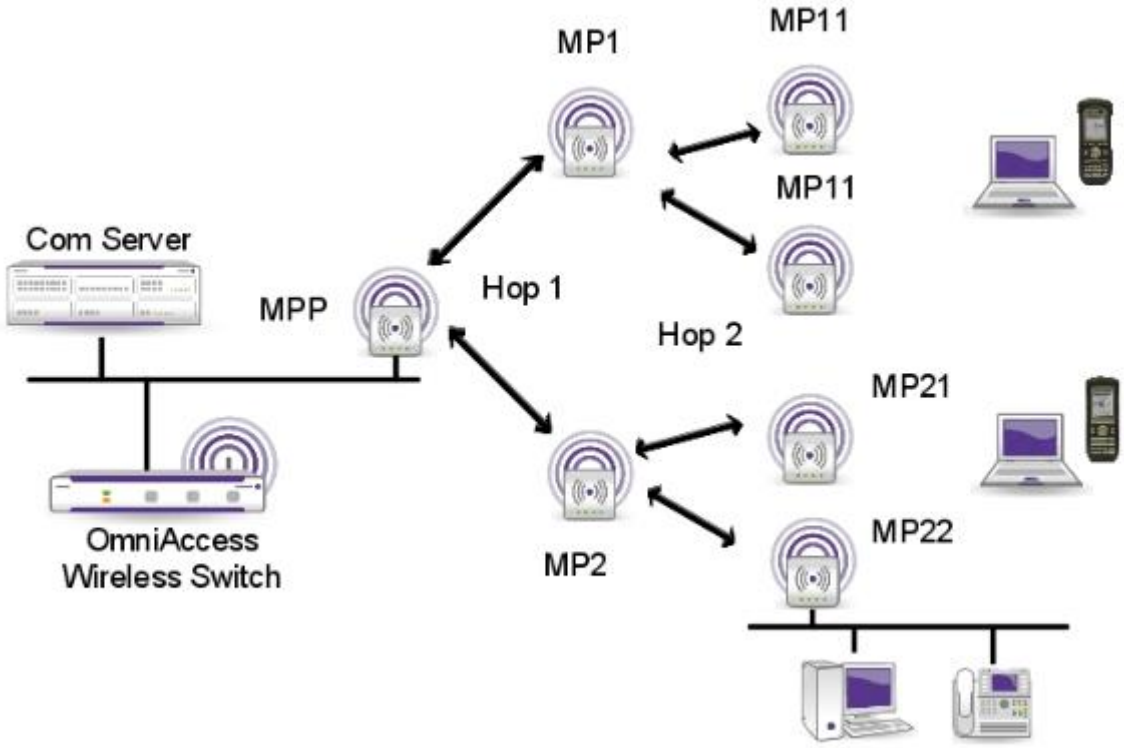
Mesh bridging provides communications (voice and data) from one LAN to another LAN via a radio link.

CAC limitation only applies to VoWLAN handsets.

The mesh portal and mesh point may connect WLAN clients.

Complex topology example

Multi hops, backhauling and mesh bridging can coexist in the same mesh.

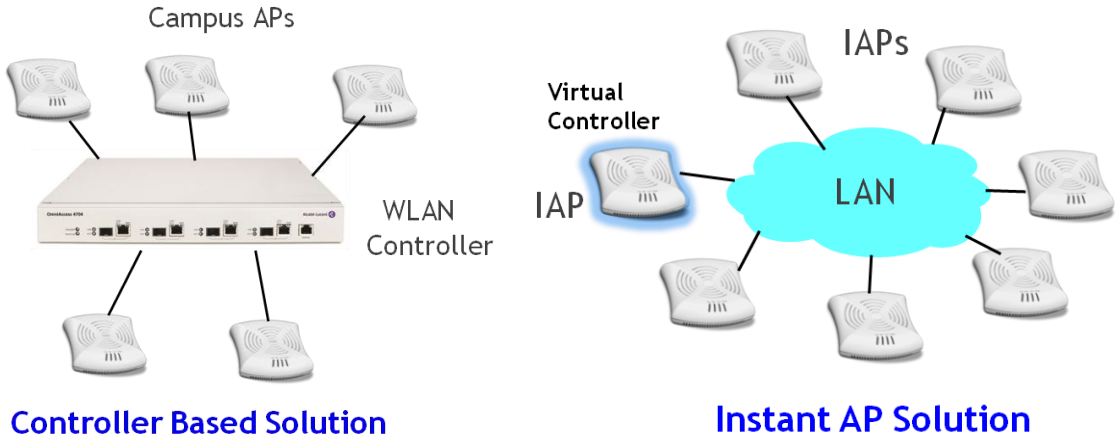


WLAN configuration recommendations:

- Compression algorithm: G711
- Framing: 20ms
- Security: WPA2/PSK
- Standard mode: 802.11a or 802.11g or 802.11n

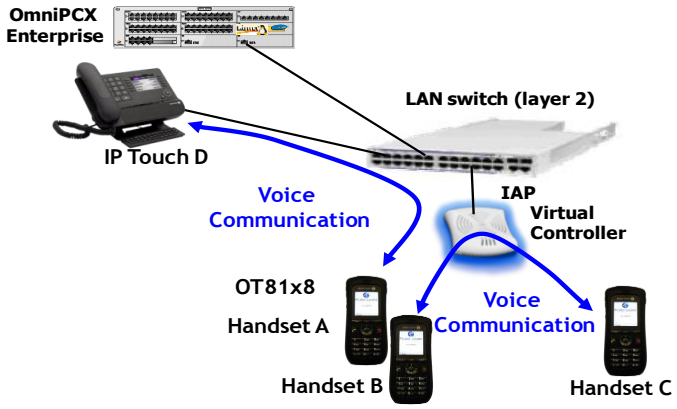
3.3.5.3.4 Instant access point

Instant AP is a controllerless WLAN solution based on a Virtual Controller (VC) and does not require any license.



The OmniAccess Instant can be installed at a single site or deployed across multiple geographically-dispersed locations. Up to 16 OmniAccess Instant Access Points (IAPs) can be controlled by a single IAP that automatically becomes a primary virtual controller.

The VoWLAN solution is also available for an Instant Access Point infrastructure.



OT81x8 handsets are supported on Instant AP

IAP behavior is similar to a Campus AP managed by a WLAN controller:

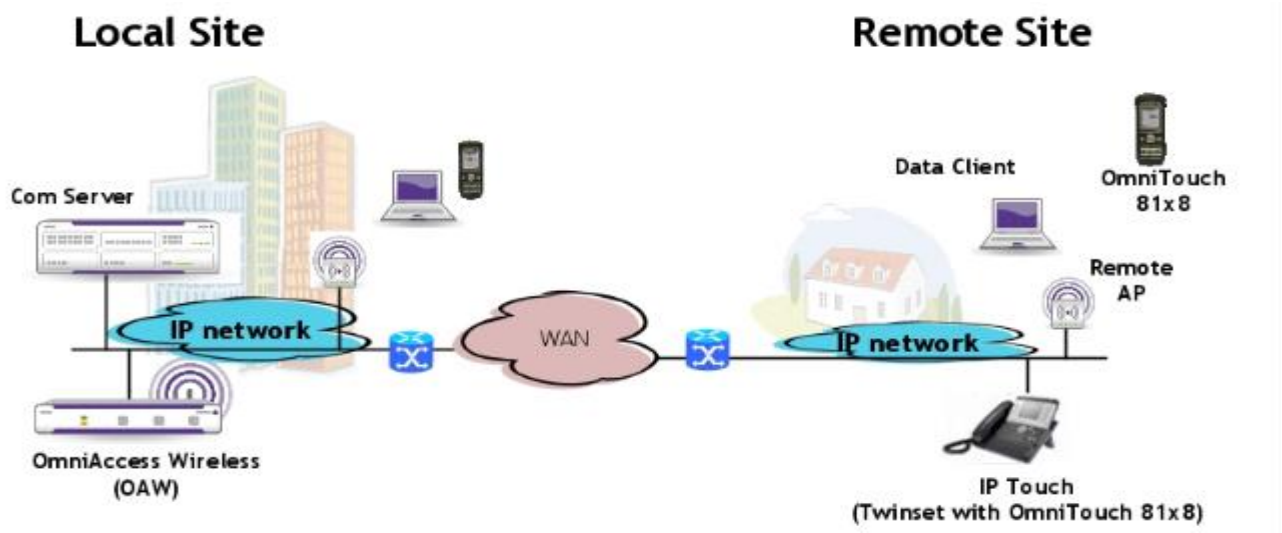
- Direct RTP between handset A and IP Touch D, and between handsets B and C

The single IAP acts as Virtual Controller

3.3.5.3.5 Remote access point

The remote access point feature allows an Access Point to be deployed on a remote site and be securely connected to the WAN controller using a VPN over the WAN.

Typically, a remote AP is used to link a home worker to a headquarters office (only one voice user per remote AP).



Intranet: this network is trusted; firewalls and NATs (Network Address Translation) are not required

Internet: this network, not trusted, requires firewalls and NAT on a remote and/or local router. Remote IP touch sets are not supported. VPN used on remote access points avoids NAT issues.

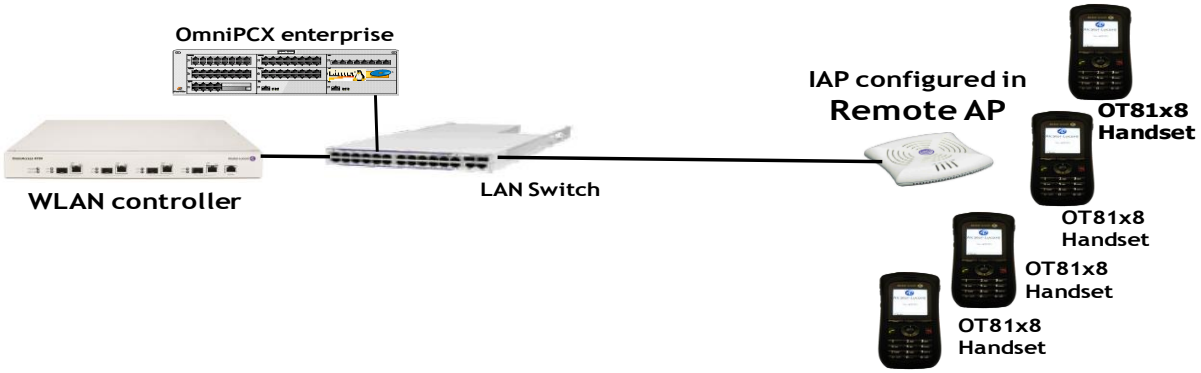
The IP Touch and the 81x8 operate in twinset mode.

The required bandwidth can be calculated with the following information:

- One call from an IP Touch requires 150kb bandwidth
- One call from an 81x8 requires 140kb bandwidth

The remote AP can also be deployed behind an ADSL Wi-Fi router.

Depending on the available WAN bandwidth, several Alcatel-Lucent OmniTouch 8118/8128 WLAN Handsets can be deployed on the remote AP as in figure: Remote access point - multi-session



3.3.5.4 VoWLAN handsets

Alcatel-Lucent offers the industry's most versatile and complete wireless solution for the workplace. Mobile IP Touch Wireless Telephones are designed for a broad range of enterprise applications, from general office to industrial use.

The Alcatel-Lucent OmniTouch 8118/8128 WLAN Handsets provide:

- Time saving benefits for voice and data applications
- Alcatel-Lucent proprietary protocol phone services such as caller name display for phone book members
- Excellent voice quality throughout the workplace
- Improvements for mobility, responsiveness, and productivity

The lightweight OmniTouch 8118/8128 WLAN Handsets are extremely simple to use, require minimal training, and are durable enough to withstand the rigors of workplace use. The rugged design has no moving parts or external antenna. A complete set of accessories is available including headsets, chargers, and carrying cases. OmniTouch 8118/8128 WLAN Handset offer more than just telephone communication.

A push-to-talk functionality is available with the Alcatel-Lucent OmniTouch 8128 WLAN Handset to broadcast communication between employees, eliminating the need for two-way radios or walkie-talkies. By putting Wireless to Work, Alcatel-Lucent has helped many commercial enterprises to improve productivity, responsiveness, and customer service.

Alcatel-Lucent's enterprise telephony integration capabilities, standards-based wireless architecture, excellent voice quality, and portfolio of handsets make Mobile IP Touch wireless telephones the right choice for wireless LAN telephony.

The Alcatel-Lucent OmniPCX Enterprise Communication Server R10.0 supports configurations without any additional servers for WLAN handsets in an Alcatel-Lucent WLAN infrastructure. The Alcatel-Lucent OmniTouch 8118/8128 WLAN Handsets support:

- 802.11e Wi-Fi Multimedia (WMM)
- Enhanced Distributed Channel Access (EDCA)
- WMM Power Save (U-APSD)

Alcatel-Lucent OmniTouch 8118/8128 WLAN Handsets are compliant with Call Admission Control, based on TSPEC & WMM Admission Control (AC), as well as CCXv2.

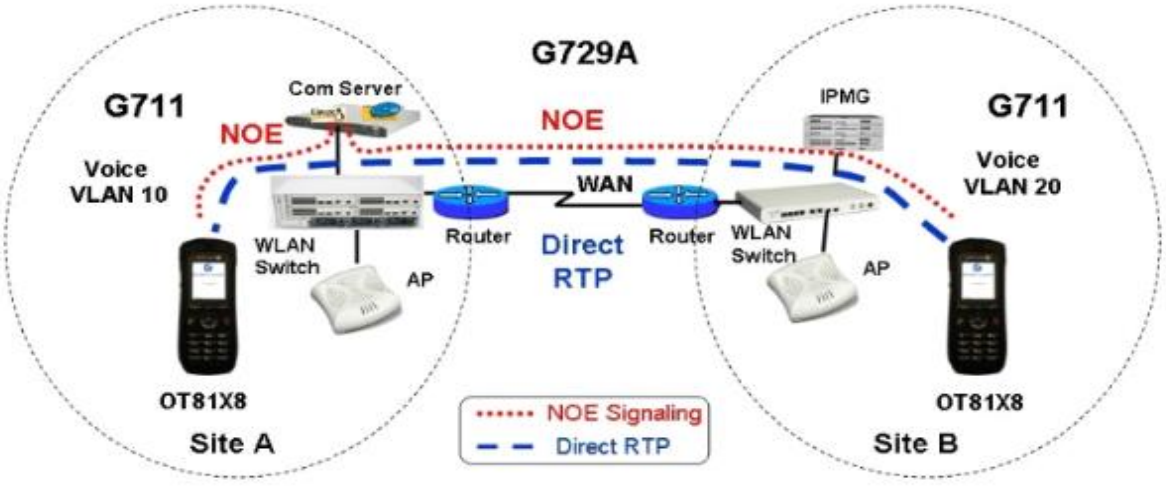
With the implementation of Direct RTP and New Office Environment (NOE) protocol on Alcatel-Lucent OmniTouch 8118/8128 WLAN Handsets, calls are handled transparently. OmniTouch 8118/8128 WLAN Handsets communicate with every other set in the same way as an IP Touch set.

Note: For details about OmniTouch 8118/8128 WLAN Handset compatibility, refer to the "Alcatel-Lucent OmniTouch 8118/8128 WLAN Handsets on Specific WLAN Infrastructures" Premium Customer Support available from the Enterprise Business Portal.

The following diagrams indicate the call progression from an Alcatel-Lucent OmniTouch WLAN Handset Site A to another Alcatel-Lucent IP Touch WLAN Handset in site B via a WAN and without additional compression/decompression.

Reminder: IP Domains are used to perform CAC control on the WAN:

- G711 in Intra-domain (Sites A & B)
- G729A in Extra-domain (WAN)



In a Site to Site configuration, a call between two OmniTouch WLAN handsets (OT8118/OT8128) is treated as an IP Touch phone call with the implementation of Direct RTP. The G711 algorithm is used for local communication on each site and G729A is configured on the WAN to reduce bandwidth consumption.

Security

Wi-Fi sets support the WPA2 security mechanism. This protocol is based on the final IEEE 802.11i amendment of the 802.11 standard.

WPA2, like WPA, has two operational modes: Enterprise and Personal.

Enterprise mode uses:

- PEAP-MSCHAPv2
- EAP-TLS
- EAP-FAST

Personal mode:

- Based on a PreShared Key model, WPA2, like WPA, creates a new session key at every association.

The encryption keys used for each client are unique on the network and specific to each client. Ultimately, every client sends packets over the air, encrypted with a unique key. WPA2 is more robust than WPA. WPA2 uses the AES encryption algorithm instead of RC4 Security (used by the first version of WPA).

Rogue AP detection is performed by the WLAN controller.

Site requirements

The existing WLAN infrastructure must be studied for compatibility with the Wi-Fi telephony. This includes the following tasks:

- All WLAN products must be part of a certified list for compliancy.
- The topology must provide enough bandwidth for voice communication.
- The IP scheme used (L2 and L3) needs to be analyzed to fit the architecture.

To ensure correct RF coverage for providing seamless handovers, a Voice site survey is mandatory.

Refer to the "Alcatel-Lucent OmniTouch 8118/8128 WLAN Handsets on Specific WLAN Infrastructures" available on the Business Portal.

3.3.6 OmniMobility DECT

3.3.6.1 DECT infrastructure

To meet corporate user mobility requirements in company premises, the Alcatel-Lucent OmniPCX Enterprise Communication Server offers a wireless telephone service based on the international DECT (Digital Enhanced Cordless Telecommunications) standard.

The DECT standard is a cellular technology that uses the 1880/1900 MHz frequency band. DECT is available:

- In all European countries
- In a large number of Asian and African countries. The 1900/1930 MHz bandwidth is used for China, Thailand and Latin American.

The DECT standard is designed to provide mobility services in environments with high user density such as large buildings or campuses: 10 000 Erlangs/Km sq. (GSM 200 Erlangs/Km sq., DCS 500 Erlangs/Km sq.).

This standard is based on a digital technology providing high quality communication, with Roaming and Handover (Handoff) capabilities.

CDCS (continuous dynamic channel selection) is a unique feature that ensures that every mobile phone operates on the best available radio channel. In addition, no frequency planning is required when adding a radio base station. All base stations can transmit on any channel.

The Alcatel-Lucent OmniPCX Enterprise Communication Server integrates mobility components based on the DECT technology, offering ergonomics, security, with a user-friendly management interface.

The DECT wireless solution is fully integrated with the Alcatel-Lucent OmniPCX Enterprise VoIP & TDM solutions. A DECT (Digital Enhanced Cordless Telecommunications) set is seen as a TDM UA set using the AGAP (Alcatel-Lucent Generic Access Profile) protocol.

3.3.6.1.1 Alcatel-Lucent DECT mobility components

The DECT mobility service is built by connecting DECT radio base stations to the Alcatel-Lucent OmniPCX Enterprise. This infrastructure offers indoor and/or outdoor radio coverage enabling any DECT handset to be connected to OmniPCX Enterprise services and applications, and to operate as any other proprietary extension of the OmniPCX Enterprise.

A DECT phone set is a mobile device that can be used as users move around. Using their DECT handset, users can make or receive calls and also use phone services in the same way as UA Reflexes (digital) telephone users.

The base station is the radio interface between the DECT handset and the OmniPCX Enterprise which provides the corporate phone services. An individual base station has a range of approximately 300 meters in an open geographic area. This area is referred to as a "cell" and the combined group of cells is referred to as the "coverage area." An OmniPCX Enterprise can support several base stations

The DECT solution offers user mobility and roaming services to make a call and maintain the communication while physically moving from one cell to another cell pf the company coverage area. The OmniPCX Enterprise maintains each call during handoffs between cells.

Alcatel-Lucent DECT products offer optimized base stations:

- IP-DECT Base Station available in two versions:

Indoor use:

- 8340 IP-DECT AP with integrated antennas
- 8340 IP-DECT AP external antennas
- 8340 IP-DECT 8dBi Gain antenna
  Polarization: dual linear, ±45° slant

Outdoor use with 8340 IP-DECT Outdoor box, the outdoor box can contain either

IP-DECT AP with external antennas with 8dBi gain antenna or other external gain antenna

IP-DECT AP with integrated antennas

8340 IP-DECT Base Station is directly handled by the Communication Server via an IP connection allowing up to 11 simultaneous calls.

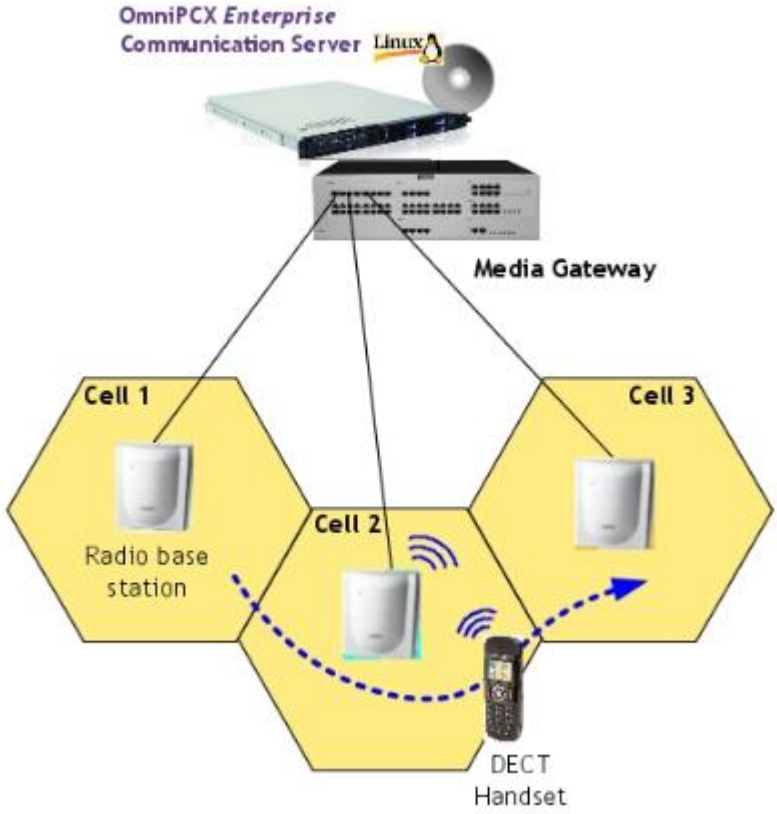
- TDM Base Station available in two versions:
  - Intelligent Base Station (IBS) available in two versions: indoor (4070 IO) and outdoor (4070 EO). IBS can be connected to UA boards (Crystal Hardware) or UAI/MIX boards (Common Hardware) allowing up to 6 simultaneous calls.

A4070 IO

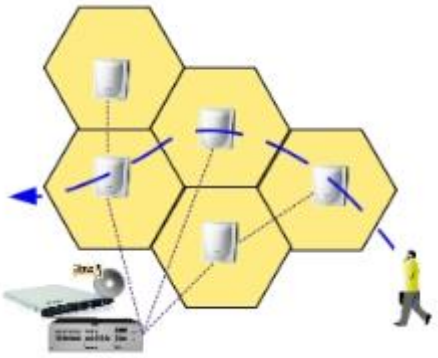
A4070 EO

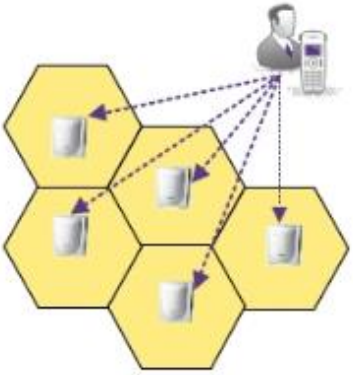
  - Radio Base Station (RBS). RBS are connected to DECT boards on Crystal Hardware allowing up to 12 simultaneous calls.

A professional DECT wireless device called Alcatel-Lucent 8232 DECT Handset. These Alcatel-Lucent DECT Handsets offer access to the same OmniPCX Enterprise voice services as TDM or IP desktop phone sets.



Alcatel-Lucent DECT products provide an optimal traffic capacity, a high voice quality and seamless roaming and handover between cells:





Handover: During a conversation, a mobile user can move within the company premises without any interruption or interference.

Roaming: A mobile user can make or receive calls from any location in the OmniPCX Enterprise radio coverage area. The DECT handset is always synchronized with a radio base station and can switch from one base station to another.

To cover a site, radio base stations, connected to the OmniPCX Enterprise, are mounted to create a private cellular network.

A radio coverage survey is necessary and must be conducted to define the number of base stations needed at specific locations. All internal calls are free of charge. External calls bear the same cost as calls from any wired phone.

The signaling for the base station and the DECT sets is included in the media gateway signaling. For each media gateway, the signaling bandwidth needed is about 9.6Kbps for 250 users. The protocol used is UA signaling end to end.

3.3.6.1.2 High level architecture

The Alcatel-Lucent DECT solution is an integral part of the Alcatel-Lucent OmniPCX Enterprise system. DECT relies on a mix of wired and wireless infrastructure. The Communication Server establishes end-to-end signaling with the DECT set. This makes it possible to deploy DECT sets at any one of the remote site by connecting the base stations to the Media gateways.

A Communication Server manages all the sets (wired or wireless) at the sites through signaling links. Signaling is direct to IP sets, but for TDM and DECT sets signaling, is established via the Media gateway. Every set configured on the Communication Server is visible in the OmniPCX Enterprise network, which entails that DECT users can make and receive calls to/from any user in the network.

The media gateway communicates with the DECT sets via the base stations connected to the digital ports (UA). Up to the base station, the physical characteristics correspond to the OmniPCX Enterprise digital port physical characteristics (based on 3B+D architecture). Beyond the base station, Alcatel-Lucent DECT abides by standard DECT wireless technologies. DECT handsets have their signaling link established with the Communication Server, as long as it is within the base station coverage. Users can move with their set across the DECT coverage area and can communicate with no interruption. The seamless handoff between base stations belonging to a media gateway is what makes this possible. The roaming feature allows users to visit, be recognized, and use all the services available at their originating site.

Each DECT set configured within the user database of the system has a unique number. The DECT set has all the characteristics defined for a wired extension and can access to all the available system services. The DECT set is assigned to the IP Domain and the entities configured of the site. Therefore, it follows the site routing characteristics while making or receiving calls.

3.3.6.1.3 Architecture providing DECT services

The OmniPCX Media Gateway is equipped with a hardware board which connects to a base station. The base Station connects to a UA (digital) port on the Media gateway. There are several types of boards providing UA ports:

UAI board

The UAI board comes in different models: UAI4, UAI8, or UAI16

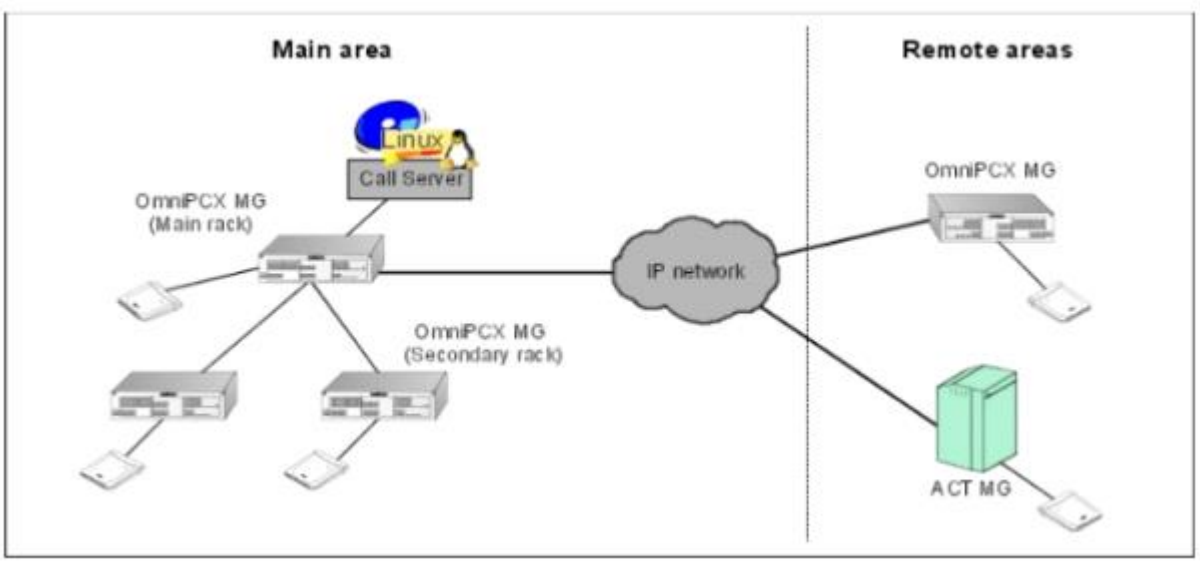
Mixed board

The Mixed board provides mixed interfaces: ISDN (T0) / UA / analog (SLI) out of all the installed mixed boards; the UA port support is 0, 2, or 4.

Reference	Modularity		
	T0	UAI	SLI
MIX4/8/4	4	8	4
MIX4/4/8	4	4	8
MIX2/4/4	2	4	4

Each base station is connected to two consecutive ports on a UAI or MIX coupler board. The master link for each base station must be declared in system configuration settings on an even-numbered equipment location (e.g., 4) and physically connected to the board by a 2-pair cable.

The following diagram illustrates the architecture details:



A site survey is mandatory and is the only way to determine the number of necessary base stations and avoid gaps in user coverage.

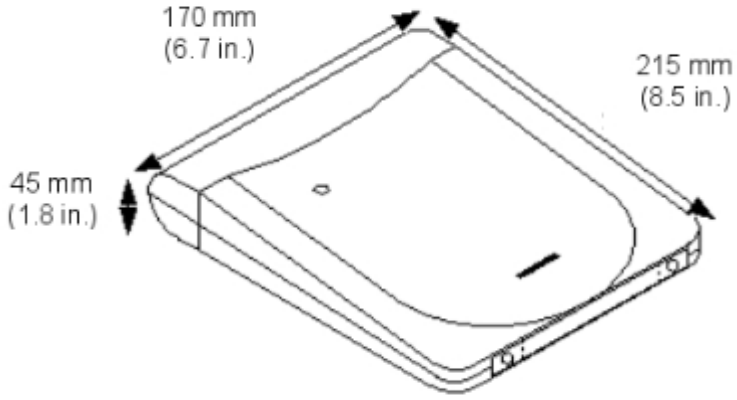
3.3.6.2 Radio base stations

3.3.6.2.1 Optimized indoor base station (4070 IO IBS indoor)

The 4070 IO IBS indoor is designed for cost-effective radio coverage and provides six simultaneous communication channels. The radio base station characteristics are:

- Radio coverage from 50 meters to 300 meters (approximately 55 yards to 328 yards) depending on location and environment

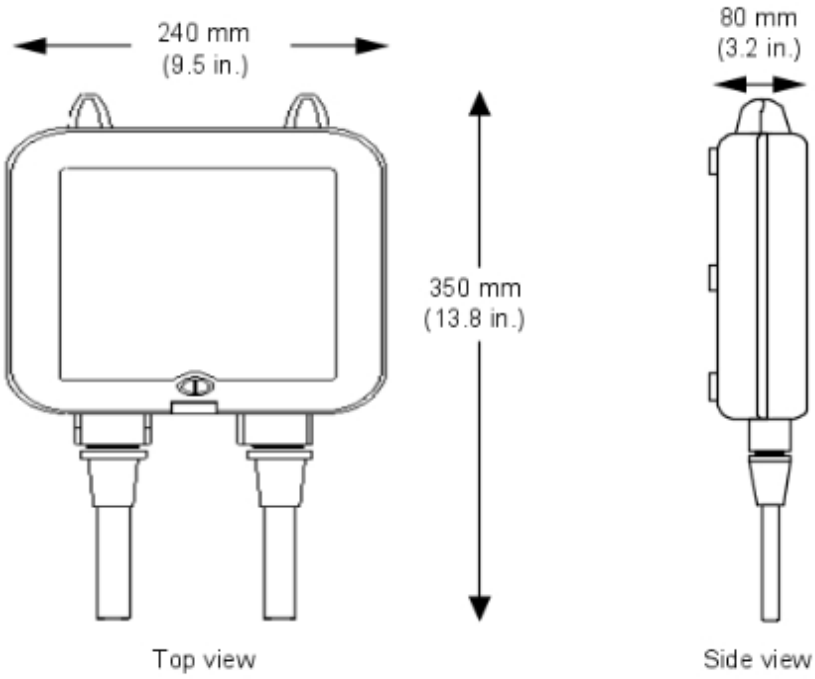
- Connections to the OmniPCX ACT:
  - Two adjacent standard UA ports
  - Twisted-pair cable (maximum distance: 1200 meters / approx. 1,312 yards)
  - Remote power feed through the system or (internal power via a 230V/42V battery (150 mA)
  - 256 IBS base stations is the maximum number handled by an Alcatel-Lucent OmniPCX Enterprise Communication Server
- Antenna
  - Built-in antenna
  - Connector for external antenna
  - Switched antenna diversity
- Environment
  - Operating temperature: +10°C to +40°C (+50°F to +104°F)
  - Environment protection: IP 20
  - Wall-mountable
- Number of users in the same cell
  - 2.8 Erlang/4070 IO-two UA links can support up to 14 standard users per cell
  - Traffic handling based upon a standard user's traffic estimated at 0.2 Erlangs



3.3.6.2.2 Optimized outdoor base station (4070 EO IBS outdoor)

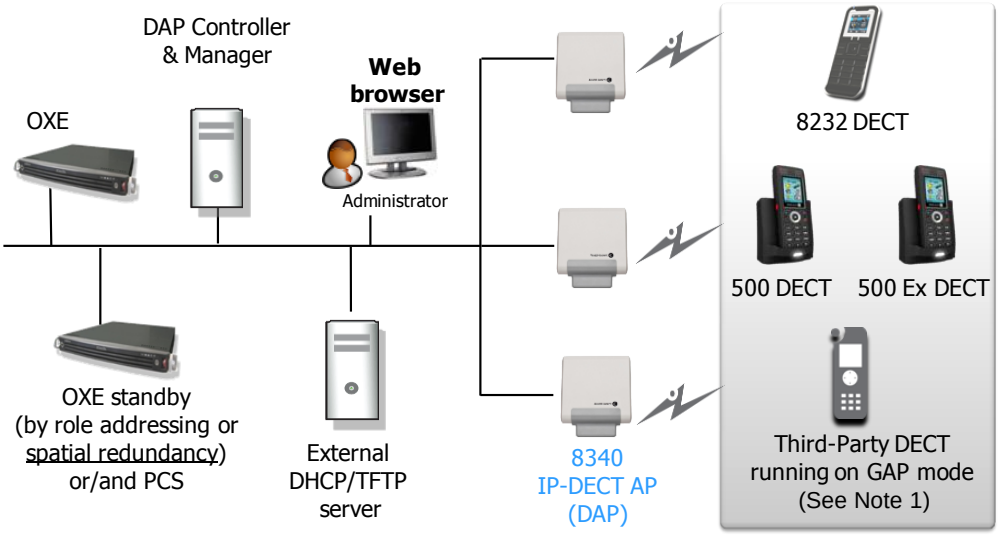
The 4070 EO IBS outdoor is designed for outdoor use. The differences between 4070 IO IBS indoor and 4070 EO IBS outdoor are:

- Remote power feeding only through the system
- External antenna
- Operating temperature: -20°C to +55°C (approx. -4°F to +131°F)
- Environment protection: IP 55



3.3.6.2.3 8340 IP-DECT Access Point

8340 IP-DECT Access Point has been designed to offer DECT connectivity on IP/Ethernet networks.



Note 1: Third-party DECT handset support requires validation on the field (Under Business Partner responsibility)
For further information, please check with Technical Communication TC0678 named "Public GAP SETS ON OXE"

Mechanical characteristics	8340 IP-DECT

Dimensions (h x w x d)	Indoor: 174x145x43 mm – 6.85x5.70x1.69 in. Outdoor box: 240x290x88 mm – 9.45x11.42x3.46 in.
Weight	Indoor: 302g – 10,65oz Outdoor: 1,23 Kg – 43,39oz
IP class	Indoor IP40, Outdoor box: IP66
Operating Temp.	Indoor: 0 +45°C, +32 +113°F Outdoor: -15 +45°C +5 +113°F
Operating humidity	Storage: 5 to 95% non-condensing Operating: 15 to 95% non-condensing
Mounting	Mountable on wall & ceiling
Antennas	Integrated omnidirectional External (SMA connector)
IP connectivity	
PoE voltage	36-57V DC
PoE Class	Class 2
Power consumption	6,49W max
Local power feeding	Yes, optional PoE adaptor
IP Network	10/100Base-T, IEEE802.3
IP connector	RJ45
IP Cabling	Cat 5 UTP or better
IP version	IPv4
DHCP/TFTP support	Yes
DTMF generation	RFC2833
Multicast	RFC1112 (network must support multicast)
QoS	IEEE 802.1Q, IEEE 802.1P

Audio codecs	ITU-T G711 (A,µ), G729AB
Framing	20, 30, 40, 50 and 60 ms
Branch Office support	Yes
Echo cancellation	Yes
Serviceability	Downloadable software Web based management tool
DECT connectivity	
DECT Frequency bands	EMEA: 1880-1900 MHz Latin America: 1910-1930 MHz North America: 1920-1930 MHz Asia: 1900-1906 MHz
Antenna	Integrated omnidirectional or SMA connector for external antenna
Sensitivity	Typical -90 dBm measured at antenna connection at BER=0.001
Range	Indoor typical: 20-50m Outdoor typical: 300m
DECT Protocol	GAP, AGAP (AGAP is encapsulated in SIP)
DECT Security	Identity, Authentication, Encryption
No. of simultaneous calls	11
Audio codec	G726
Maximum AP/system	256, up to 750 with specific installation rules and PCS process
Mixed configurations (IP-DECT with 4070xx)	Not supported

An 8340 IP-DECT DAP manager/controller is required for IP-DECT configuration, administration and management:

- To configure the IP-DECT infrastructure
- To provision DECT handset subscription

- To manage mobility roaming in a multi-site configuration
- To collect IP-DECT performance and synchronization data

The software can be downloaded from the Alcatel-Lucent Web Portal.

There is no redundancy of the DAP Manager.

When the DAP manager is not up-and-running, the DECT solution still works, but the following actions are no longer available:

- IP-DECT configuration (installation and management),
- DECT handset roaming between remote site in a multi-site topology
- Automatic data subscription distribution

3.3.6.2.4 Mix of TDM and IP DECT

Both TDM and IP DECT infrastructures can be mixed within the same Communication Server solution.

Due to the difference of technology, this kind of deployment is possible without coverage overlap. A remote site can be equipped with IP DECT Access Points, even if other sites are deployed with a TDM infrastructure.

This mixity is not possible for the OmniPCX Enterprise DECT Campus service.

3.3.6.2.5 Comparison highlight TDM/IP-DECT

	OXE TDM DECT solution		OXE IP DECT solution
	IBS	RBS	
Total AGAP DECT handsets	5000		1500
Pari number	1	8	1
Maximum APs	256	250 (1000 multi-pari)	Up to 256 natively Up to 750 with specific DECT survey rules
Simultaneous calls per AP	6	12	11
Roaming	YES	YES	YES
Handover	YES	YES	YES
Campus topology with high APs scalability	Managed by OXE, thank to "DECT Campus" feature (Up to 1000 base stations)		Managed by IP DECT infra (Up to 750 APs)*
WW offer	YES	NO	YES

3.3.6.2.6 Gain antenna

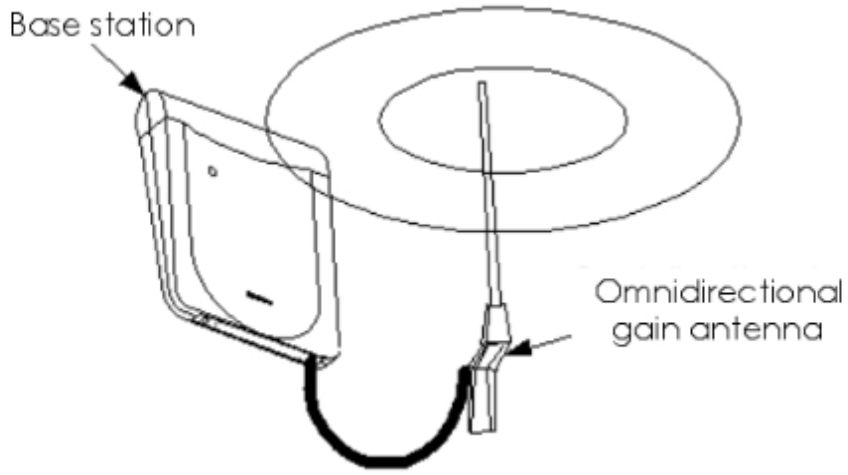
In certain instances, gain antennae may be useful to reduce the number of radio base stations which can entail a significant cost decrease. Gain antennae may reduce the number of base stations needed for outdoor coverage by a factor of three. They may be connected to a RBS or an IBS base station.

Two types of gain antennae are available:

- Omnidirectional antenna
- Directional antenna

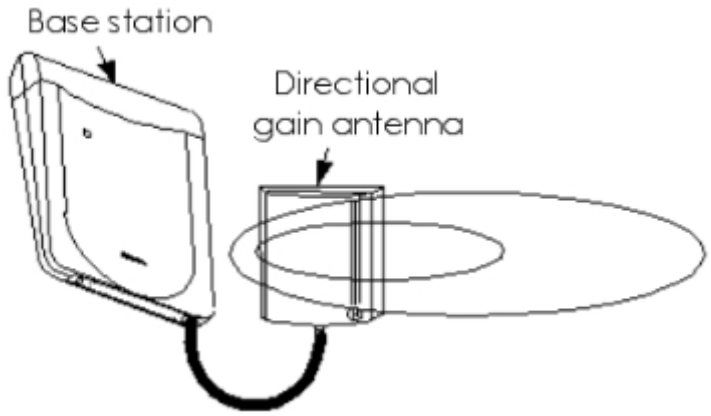
Omni directional antenna

This type of antenna is used in open areas (parking lots, sales areas) or in buildings with one floor.



Directional antenna

Directional gain antenna increases the radio signal in one specific direction.



3.3.6.3 DECT telephone services

DECT Telephone Services features include:

Message notification

The display message icon lights when there is a message (text, voice mail, and unanswered call) waiting.

Text and voice messaging

The Alcatel-Lucent DECT handsets have access to the following services:

- Internal text message mailbox
- Number of new text messages
- Read, save content
- Answer or the sender back
- Send new messages (custom or standard messages and messages to be completed)
- Unanswered ISDN calls
- Number
- Read and save caller identity (ID)
- Callback
- Voice mailbox: direct access to the voice mailbox with DTMF mode automatically on (voice guidance).

Voice MAILBOX

Users have direct access to a voice mailbox with DTMF enabled by default (voice guidance).

Multi-line mode

The Alcatel-Lucent DECT handsets can operate as multiline sets. The second calling line appears as an icon.

Twinset service

Many employees have two phones:

- A wireless phone for use away from their desk
- A desktop phone with convenient user interface

To simplify the use of these two telephones, the Alcatel-Lucent OmniPCX Enterprise Communication Server supports the twin set feature, which allows to use either fixed and mobile telephones, transparently, as if they were the same sets.

Mobility in network

People who work at different company sites have access to the same level of communication and services as if they were working in their own office. This includes optional automatic call forwarding to an assistant, call screening, and user profiles (manager or assistant). Additional available services include:

- Voice mail: same level of service on a visited node as on the home node
- Voice mail notification and access
- Supervision: same level of service on a visited node as on the home node
- Callback request
- Callback on free requests are maintained when roaming
- Callback on busy requests are converted to callback on free when the phone moves onto another node
- Manager/assistant screening

In addition, the supervision feature makes it is possible to build up multi-site teams without relocating employees.

Visitor registration

Visitors (with or without their own mobile handset) may be registered as Alcatel-Lucent OmniPCX Enterprise Communication Server users. The OmniPCX Enterprise registers visitors with their first and last names, class of service, charging mode, connection class of service, cost center, and the handset

IPUIN. The final registration date may also be defined. After this date, the handset is no longer authorized to make external calls. The registration process may be performed from the attendant console to enable quick configuration.

Overflow to a directory number

If a wireless phone does not answer when paged (switched off, out of coverage, etc.), the Alcatel-Lucent OmniPCX Enterprise Communication Server reroutes the call to a predefined directory number.

Miscellaneous

People, working in another part of company premises, benefit from the same level of services as if they were working in their offices. For example:

- Caller name identification
- Multi-line capability
- Notification with telephone icons
- Programmable keys
- Transparent access to all telephone services
- Object supervision
- Text messaging
- Voice mailbox
- Alarms

Conversation services

The Alcatel-Lucent DECT 8232/8242 handsets provide all of the following features:

- Call transfer
- Caller number/name display
- Callback
- Conferencing
- Mute
- Hang up
- Answer
- Waiting
- DTMF number sent
- Volume control
- Directory access
- Short-dialing keys
- Call diary (receive, lost, etc.)
- Enter / Leave a group line

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